SOIL SURVEY OF

Tom Green County, Texas

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Texas Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in the period 1963-70. Soil names and descriptions were approved in 1971. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1971. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Concho, North Concho River, and Eldorado Divide Soil and Water Conservation Districts.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Tom Green County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the range sites.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Ranchers and others can find, under "Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and recreation areas in the section "Town and Country Planning."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Tom Green County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "General Nature of the County."

Cover: Cotton and grain sorghum, the major crops in Tom Green County, planted in a skip-row pattern on an Angelo clay loam.

Contents

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SOIL SURVEY OF TOM GREEN COUNTY, TEXAS

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SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION

TOM GREEN COUNTY is in west-central Texas (fig. 1). The total area of the county is 1,546 square miles, or 989,440 acres, of which 16,120 acres is lakes that have a fluctuating water level. In 1970 the population was 71,047, and about 90 percent of it was urban and 10 percent was rural. San Angelo, the county seat, has a population of about 64,000.

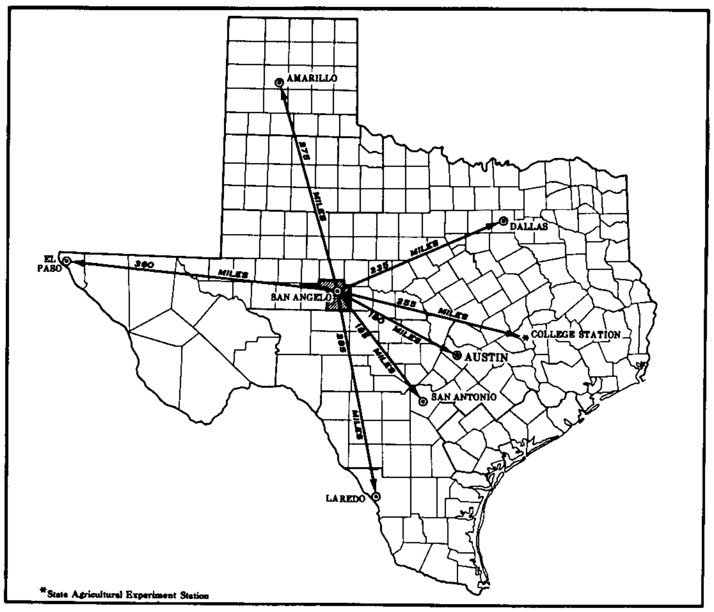

Figure 1.—**Location of Tom Green County in Texas.**

The average annual rainfall is 19 inches, the average annual temperature is 65° F, and the average freeze-free period is 232 days. The elevation ranges from 1,600 to 2,500 feet above sea level.

Tom Green County is served by one major airline, one railroad that has freight connections to all points, and many highways.

The county is a major producer of wool and sheep, and the city of San Angelo is a major market for wool and lambs. Within the State of Texas, Tom Green County is a major producer of grain sorghum and cotton and is a major dairy area. Also important to the economy of the county are a military base, petroleum production, manufacturing facilities, and a university.

The university and two high schools are in San Angelo. The enrollment at the university is about 4,000 students. There are more than 100 manufacturers in San Angelo, and they produce 30 different items. Among the products are leather goods, boots, and medical supplies. These companies also process food and food supplements.

About 181,000 acres in the county is nonirrigated soils used for crops, 13,800 acres is irrigated soils used for crops, 712,000 acres is in range, and the remaining acreage is urban areas, water, or federally administered land. A wide variety of field crops, vegetables, and orchard trees could be grown if more water were available for irrigation.

About 326,000 acres, or 33 percent, of the acreage of the county has a slope of less than 1 percent. This acreage is used for crops or is well suited to them. About 130,000 acres, or 13 percent, of the acreage of the county has a slope of 1 to 3 percent. This acreage is also suitable for crops, but more measures are needed to control erosion on it than are needed in areas where slope is less than 1 percent. Most of the remaining acreage is too steep or too shallow for field crops.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Tom Green County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Amarillo and Mereta, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Olton clay loam, 0 to 1 percent slopes, is one of several phases within the Olton series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Three such kinds of mapping units are shown on the soil map of Tom Green County: soil complexes, soil associations, and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the dominant soils are joined by a hyphen. Kimbrough-Owens complex, 1 to 8 percent slopes, is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the name or names of the dominant soils. Tarrant association, undulating, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. Rioconcho and Spur soils is an undifferentiated soil group in this county.

In most areas surveyed, there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Urban land is a land type in this county.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Tom Green County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Tom Green County are discussed in the following pages.

1. *Tarrant–Ector association*

Very shallow to shallow, undulating to hilly, calcareous soils on limestone hills

This association consists of soils that formed over limestone.

The association makes up 40 percent of the county. About 80 percent of the association is Tarrant soils, 15 percent is Ector soils, and the remaining 5 percent is minor soils.

Tarrant soils are very dark grayish-brown cobbly clay. They are about 10 inches deep over hard limestone.

Ector soils are grayish-brown very gravelly clay loam. They are about 8 inches deep over fractured limestone.

Kavett, Angelo, Rioconcho, and Dev soils are the minor soils in this association. They are mostly in the narrow valleys.

This association is used mainly as range and for wildlife habitat. Ranches are from 2,000 to 20,000 acres in size. Deer and turkey are the main game animals.

2. *Kimbrough–Mereta–Angelo association*

Very shallow, shallow, and deep, nearly level to sloping and undulating, calcareous soils on outwash plains

This association is in broad valleys of tributaries of the Concho River.

The association makes up 32 percent of the county. About 28 percent of the association is Kimbrough soils, 18 percent is Mereta soils, 18 percent is Angelo soils, and the remaining 36 percent is minor soils.

Kimbrough soils are grayish-brown gravelly loam. They are about 9 inches deep over indurated caliche.

Mereta soils are clay loam. They are about 18 inches deep over indurated caliche. The upper 6 inches is dark brown, the next 6 inches is dark grayish brown, and the lower 6 inches is brown.

Angelo soils have a surface layer of dark grayish-brown clay loam about 6 inches thick. The next layer extends to a depth of 92 inches. In sequence from the top, 6 inches is dark grayish-brown clay loam, 16 inches is reddish-brown clay, 30 inches is pink silty clay loam and 34 inches is reddish-yellow clay loam.

Tulia, Olton, Estacado, Rotan, Slaughter, and Owens soils are the minor soils in this association.

About 80 percent of this association is in range, and about 20 percent is in crops. Grain sorghum, cotton, small grain, and forage sorghum are the major crops. Quail and dove are the main game birds.

3. *Angelo association*

Deep, nearly level, calcareous soils on outwash plains

This association is mostly on smooth plains.

The association makes up 21 percent of the county. About 80 percent of the association is Angelo soils, and the remaining 20 percent is minor soils.

Angelo soils have a surface layer of dark grayish-brown clay loam about 6 inches thick. The next layer extends to a depth of 92 inches. In sequence from the top, 6 inches is dark grayish-brown clay loam, 16 inches is reddish-brown clay, 30 inches is pink silty clay loam, and 34 inches is reddish-yellow clay loam.

Rioconcho, Tulia, Lipan, Tobosa, and Mereta soils are the minor soils in this association.

About 90 percent of this association is in crops, and 10 percent is in range. Grain sorghum, cotton, and small grain are the major crops. Farms are from 200 to 800 acres in size. Doves are the major game bird.

4. *Rioconcho–Spur association*

Deep, nearly level, calcareous soils on flood plains

This association consists of soils that mainly formed in alluvium in areas adjacent to the Concho River and its major tributaries.

The association makes up 4 percent of the county. About 55 percent of this association is Rioconcho soils, 20 percent is Spur soils, and the remaining 25 percent is minor soils.

Rioconcho soils have a surface layer of dark grayish-brown clay loam about 36 inches deep. The underlying material is light-brown clay loam that extends to a depth of 80 inches.

Spur soils have a surface layer of dark grayish-brown clay loam about 14 inches thick. The subsoil is light-brown clay loam about 30 inches thick. The underlying material is light-brown clay loam that extends to a depth of 80 inches.

Dev, Tulia, and Angelo are the minor soils in this association.

Once in 3 to 20 years, the major soils in this association are subject to flooding that generally lasts for less than 1 day. Flood-control dams protect some areas of this association.

About 70 percent of the association is in range, and 30 percent is in crops. Grain sorghum, cotton, and small grain are the major crops. Pecan trees and other trees grow in areas adjacent to the stream channels. Areas of this association are well suited to wildlife habitat.

5. *Olton–Cobb–Cosh association*

Deep to shallow, nearly level to sloping, noncalcareous soils on outwash plains or over sandstone

This association consists of soils that formed mainly in material weathered from sandstone, in red marine clay, and in material on outwash plains.

The association makes up 3 percent of the county. About 70 percent of this association is Olton soils, 6 percent is Cobb soils, 6 percent Cosh soils, and the remaining 18 percent is minor soils.

Olton soils formed in outwash. They have a surface layer of brown clay loam about 10 inches thick. The next layer extends to a depth of 80 inches. In sequence from the top, 4 inches is dark-brown clay; 18 inches is reddish-brown clay; 28 inches is pink silty clay loam; and 20 inches is pink clay loam.

Cobb soils formed in material weathered from sandstone. They have a surface layer of brown fine sandy loam about 8 inches thick. The next layer is reddish-brown sandy clay loam underlain at a depth of 28 inches by sandstone.

Cosh soils formed in material weathered from sandstone. They have a surface layer of reddish-brown fine sandy loam about 5 inches thick. The next layer is reddish-brown sandy clay loam underlain at a depth of 18 inches by sandstone.

Kimbrough, Angelo, Mereta, Rioconcho, Spur, Owens, Rotan, and Tulia soils are the minor soils in this association.

About 90 percent of this association is in range, and 10 percent is in crops. Grain sorghum, cotton, small grain, and forage sorghums are the major crops. This association is well suited to habitat for deer, turkey, quail, and dove.

Descriptions of the Soils

This section describes the soil series and mapping units in Tom Green County. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile; that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for dry soil unless otherwise stated.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Urban land, for example, does not belong to a soil series but, nevertheless, is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and range site in which the mapping unit has been placed. The page for the description of each capability unit and range site can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual.[1]

Amarillo Series

The Amarillo series consists of gently sloping soils at the base of hills. These soils formed in strata of local outwash of Permian and Cretaceous age.

In a representative profile the surface layer is brown fine sandy loam about 16 inches thick. The next layer is sandy clay loam that extends to a depth of more than 80 inches. The upper 14 inches is brown, the next 22 inches is reddish brown, and the lower 28 inches is reddish yellow.

Amarillo soils are well drained. Permeability is moderate. Available water capacity is high. These soils are suited to crops, but most areas are in range.

Representative profile of Amarillo fine sandy loam, 3 to 5 percent slopes, 14.8 miles west of the courthouse in San Angelo along Ranch Road 853, and 200 yards south of this road:

A1—0 to 16 inches, brown (7.5YR) fine sandy loam, dark brown (7.5YR 4/4) moist; weak, fine, granular structure and weak, fine, subangular blocky structure in upper 4 inches and slightly hard, weak, coarse, prismatic structure below a depth of 4 inches; very friable; few roots, few fine pores; few worm casts; slightly acid; gradual, wavy boundary.

B21t—16 to 30 inches, brown (7.5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak, medium, subangular blocky structure and weak, coarse, prismatic; very hard, friable; few roots, few fine pores; common worm casts; sand grains bridged by clay; slightly acid; clear, wavy boundary.

B22t—30 to 52 inches, reddish-brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak, fine and medium, subangular blocky structure; hard, friable; few roots, few pores; common worm casts; common threads and films of calcium carbonate; sand grains bridged by clay; calcareous; moderately alkaline; clear, wavy boundary.

B23tca—52 to 68 inches, reddish-yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; weak, fine, subangular blocky structure; hard, friable; about 50 percent calcium carbonate (mostly concretions ⅛ to ½ inch in diameter) in the upper part and about 20 percent soft calcium carbonate in the lower part; calcareous; moderately alkaline; gradual, wavy boundary.

B24t—68 to 80 inches, reddish yellow (5YR 7/6) sandy clay loam, reddish yellow (5YR 7/6) moist; weak, fine, subangular blocky structure; hard, friable; few concretions and soft lumps of calcium carbonate; calcareous; moderately alkaline.

[1] UNITED STATES DEPARTMENT OF AGRICULTURE. SOIL SURVEY MANUAL. Agr. Handbook 18, 503 pp., illus., with 1962 supplement. 1951.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Mapping unit	Acres	Percent	Mapping unit	Acres	Percent
Amarillo fine sandy loam, 3 to 5 percent slopes	1,200	0.1	Mereta-Urban land complex, 0 to 3 percent slopes	1,430	0.1
Angelo clay loam, 0 to 1 percent slopes	160,250	16.2	Olton clay loam, 0 to 1 percent slopes	18,170	1.8
Angelo clay loam, 1 to 3 percent slopes	42,710	4.3	Olton clay loam, 1 to 3 percent slopes	3,110	.3
Angelo silty clay, 0 to 1 percent slopes	29,010	2.9	Olton-Urban land complex, 0 to 3 percent slopes	200	(1)
Angelo silty clay, 1 to 3 percent slopes	4,620	.5	Rioconcho clay loam	7,730	.8
Angelo-Urban land complex, 0 to 3 percent slopes	2,540	.3	Rioconcho and Spur soils	32,490	3.3
Berda loam, 3 to 8 percent slopes	1,810	.2	Rotan clay loam, 0 to 1 percent slopes	5,310	.5
Cobb fine sandy loam, 1 to 3 percent slopes	1,940	.2	Slaughter clay loam, 1 to 3 percent slopes	470	.1
Cosh-Latom complex, 1 to 8 percent slopes	2,210	.2	Slaughter-Kimbrough complex, 0 to 1 percent slopes	5,060	.5
Dev and Rioconcho soils	16,820	1.7	Slaughter-Urban land complex, 0 to 1 percent slopes	750	.1
Ector association, undulating	35,320	3.6	Tarrant association, undulating	155,240	15.7
Ector association, hilly	41,010	4.1	Tarrant association, hilly	184,110	18.6
Estacado loam, 0 to 1 percent slopes	1,160	.1	Tobosa clay, 0 to 1 percent slopes	7,660	.8
Estacado loam, 1 to 3 prcent slopes	3,340	.4	Tobosa clay, 1 to 3 percent slopes	410	.1
Kavett clay, 0 to 1 percent slopes	1,200	.1	Tulia loam, 0 to 1 percent slopes	4,530	.5
Kavett clay, 1 to 3 percent slopes	14,540	1.5	Tulia loam, 1 to 3 percent slopes	31,830	3.2
Kimbrough association, undulating	85,290	8.6	Tulia loam, 3 to 5 percent slopes	2,990	.3
Kimbrough-Owens complex, 1 to 8 percent slopes	4,850	.5	Tulia-Urban land complex, 0 to 5 percent slopes	950	.1
Kimbrough-Urban land complex, 1 to 8 percent slopes	2,940	.3	Urban land	210	(1)
Lipan clay	2,130	.2	Water areas	16,120	1.6
Mereta clay loam, 0 to 1 percent slopes	30,850	3.1			
Mereta clay loam, 1 to 3 percent slopes	24,930	2.5	Total area	989,440	100.0

[1] Less than 0.05 percent.

The A horizon ranges from 7 to 16 inches in thickness and is brown or reddish brown. Reaction is slightly acid to moderately alkaline.

The part of the B horizon above the Bca horizon ranges from 24 to 40 inches in thickness and is brown, reddish brown, reddish yellow, or yellowish red. In some places the lower part of the B horizon is calcareous. The Bca horizon is at a depth of 32 to 60 inches and is 13 to 24 inches thick. In places the upper part of the Bca horizon is weakly cemented. The content of visible carbonates in this horizon is 20 to 60 percent, and there are few to many carbonate concretions.

Amarillo fine sandy loam, 3 to 5 percent slopes (AmC).—This soil is on the sides of low, rounded hills and on foot slopes of higher limestone hills (fig. 2).

Included with this soil in mapping are small areas of Cobb, Berda, and Tulia soils and of Amarillo soils that have slopes of 1 to 3 percent. The included soils make up about 20 percent of the total area of this mapping unit.

Most of the acreage of this soil is in range. This soil, however, is suited to crops, home orchards, and gardens. Cotton and grain sorghum are the main crops. Terraces and contour farming help to control water erosion, and leaving crop residue on the surface helps to control soil blowing and maintain good tilth. In places, deversion terraces and grassed waterways are needed to control water from higher lying soils. If this soil is irrigated, a system that controls loss of water is needed.

The hazard of soil blowing is moderate. This soil is subject to rapid leaching, and fertilizer is needed to obtain high production. If this soil is terraced or leveled, the depth of cuts and fills is limited by the difference in the content of clay in the surface layer and in the lower layers. Dryland capability unit IVe-2 and irrigated capability unit IIIe-1; Sandy Loam range site.

Angelo Series

The Angelo series consists of nearly level to gently sloping soils on smooth outwash plains.

In a representative profile the surface layer is dark grayish-brown clay loam about 6 inches thick. The next layer extends to a depth of 92 inches. The upper 6 inches is grayish-brown clay loam; the next 16 inches is reddish-brown clay; the next 30 inches is pink silty clay loam; and the lower 34 inches is reddish-yellow clay loam.

These soils are well drained and have slow surface runoff. Permeability is moderately slow. Available water capacity is high.

These soils are well suited to crops or to range.

Representative profile of Angelo clay loam, 0 to 1 percent slopes, 14.9 miles northeast of the courthouse in San Angelo along U.S. Highway 67 to its intersection with a county road, 0.25 mile north along the county road from the intersection, then 150 feet west of the county road in a cropped field:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak, very fine, granular and subangular blocky structure; hard, firm; compacted at a depth of 4 to 6 inches; calcareous; moderately alkaline; clear, smooth boundary.

B21—6 to 12 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, very fine, granular structure and moderate, very fine and fine, subangular blocky; hard, firm; few roots; calcareous; moderately alkaline; gradual, wavy boundary.

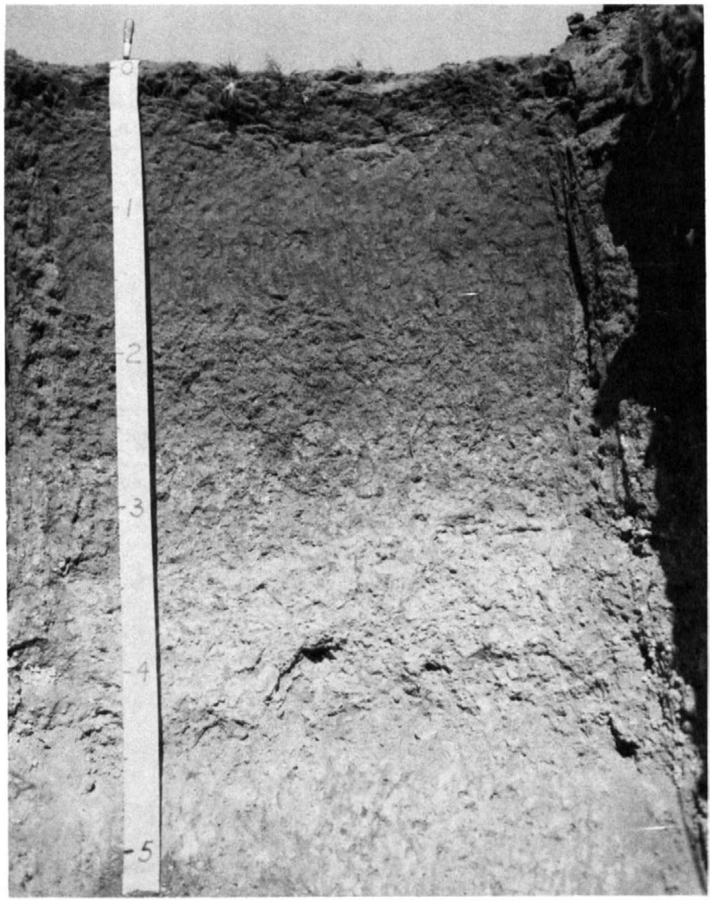

Figure 2.—**Profile of an Amarillo fine sandy loam. This soil is noncalcareous in the upper part.**

B22—12 to 28 inches, reddish-brown (5YR 5/3) clay, reddish brown (5 YR 4/3) moist; compound moderate, very fine and fine, subangular blocky structure and weak, fine, blocky; very hard, firm; few roots; few fine pores; shiny ped faces when moist; few worm casts; calcareous; moderately alkaline; gradual, wavy boundary.

B23ca—28 to 58 inches, pink (7.5YR 7/4) silty clay loam, reddish yellow (5YR 6/6) moist; moderate, very fine and fine, subangular blocky structure; hard, firm; few roots; 25 percent visible calcium carbonate, mostly in soft masses; some ped surfaces are shiny when moist; calcareous; moderately alkaline; diffuse, smooth boundary.

B24ca—58 to 92 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak, very fine to fine, subangular blocky structure; hard, less than 5 percent visible calcium carbonate; ped surfaces are shiny when moist; calcareous; moderately alkaline; clear, smooth boundary.

The solum ranges from 60 to 120 inches in thickness. Distinct accumulations of calcium carbonate begin at a depth of 24 to 40 inches. The coefficient of linear extensibility is 0.07 to 0.10 above the Bca horizon and 0.02 to 0.07 in the Bca horizon, to a depth of about 50 inches.

The A horizon is 4 to 10 inches thick. It is dark grayish brown, grayish brown, dark brown, or brown. It is clay loam, silty clay loam, clay, or silty clay.

The part of the B horizon above the Bca horizon is 13 to 40 inches thick. It is reddish brown, brown, or dark grayish brown. This horizon is clay loam or silty clay that is 40 to 60 percent clay, of which 5 to 14 percent is clay-sized carbonates. The Bca horizon is generally 6 to 40 inches thick but is as much as 60 inches thick in places. It is pink, reddish yellow, or yellowish red. It is 15 to 60 percent calcium carbonate equivalent. In some places there are two distinct horizons of calcium carbonate accumulation, and the horizon between these two horizons is 0 to 10 percent calcium carbonate. The Bca horizon is 2 to 50 percent pebbles in some places.

Angelo clay loam, 0 to 1 percent slopes (AnA).—This soil is on outwash plains. Most areas are large and are uniform in shape. This soil has the profile described as representative of the series (fig. 3).

Included with this soil in mapping are areas of a similar soil that has dark colors that extend below a depth of 20 inches. This included soil makes up 10 percent of the total area of this mapping unit. Also included are areas of a similar soil that is more clayey below the surface layer. This soil is 20 percent of the total area of this mapping unit. Mereta soils are also included. They make up 2 percent of the area.

About 85 percent of the acreage of this soil is used for crops. The remaining 15 percent is used as range. Cotton and grain sorghum are the main crops.

The hazards of water erosion and of soil blowing are slight. The main concern in the management of this soil is the maintenance of tilth. In areas where

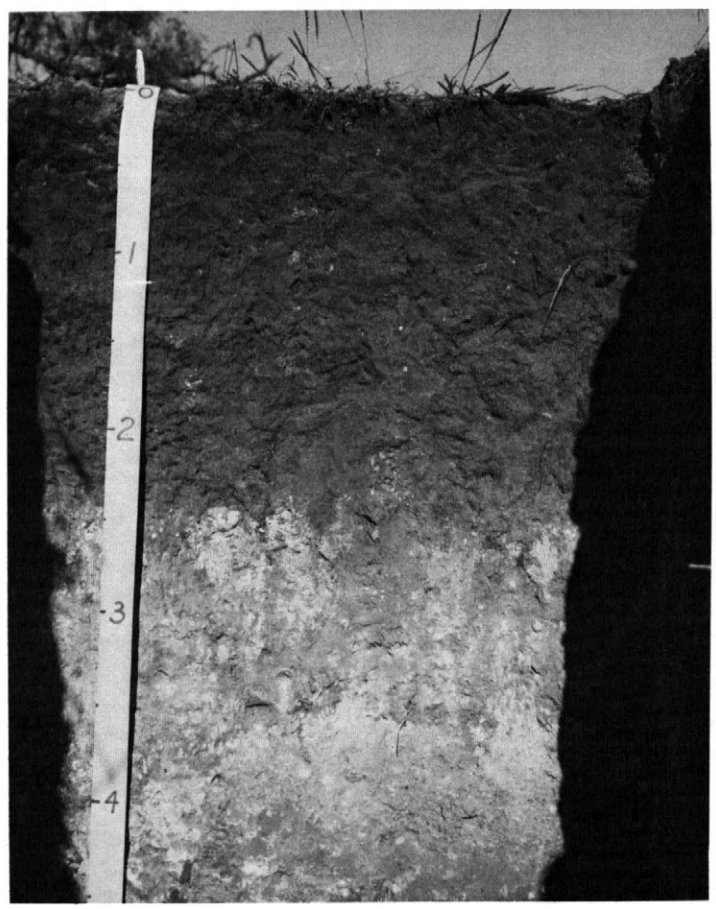

Figure 3.—**Profile of an Angelo clay loam that has a caliche layer below a depth of 28 inches.**

this soil is irrigated, an irrigation system designed to control soil and water losses is needed. Dryland capability unit IIIc–1 and irrigated capability unit I–1; Clay Loam range site.

Angelo clay loam, 1 to 3 percent slopes (AnB).—This soil is in smooth areas. It is near Angelo clay loam, 0 to 1 percent slopes.

The surface layer of this soil is grayish-brown clay loam about 5 inches thick. The next layer extends to a depth of 60 inches or more. The upper 6 inches is brown clay loam, the next 14 inches is reddish-brown clay, and the lower 35 inches is pink silty clay loam.

Included with this soil in mapping are areas of a similar soil that has dark colors that extend below a depth of 20 inches. This soil makes up about 5 percent of the total area of this mapping unit. Also included are areas of a similar soil that is more clayey below the surface layer. This soil makes up 20 percent of the total area of this mapping unit. Mereta soils are also included. They make up 2 percent of the area.

About 50 percent of the acreage of this soil is used for crops, and 50 percent is used for range. Cotton and grain sorghum are the main crops.

Runoff is medium. The hazard of soil blowing is slight, and the hazard of water erosion is moderate. The main concerns in the management of this soil are the control of water erosion and the maintenance of tilth. Terraces and contour farming help to control water erosion, and crop residue helps to maintain soil tilth. Diversion terraces and grassed waterways are needed in places to control water from adjacent areas. In areas where this soil is irrigated, an irrigation system that controls loss of soil and water is needed. Dryland capability unit IIIe–1 and irrigated capability unit IIe–1; Clay Loam range site.

Angelo silty clay, 0 to 1 percent slopes (AoA).—This soil is in valleys in areas of limestone. The average slope is about 0.5 percent. This soil commonly is in long, narrow areas that are parallel and adjacent to streams. These areas are above the normal level of flooding.

The surface layer of this soil is dark-brown silty clay about 8 inches thick. The next layer extends to a depth of 60 inches or more. The upper 7 inches is brown silty clay, the next 22 inches is reddish-brown clay, and the lower 23 inches is reddish-yellow silty clay loam.

Included with this soil in mapping are small areas of an Angelo clay loam and small areas of Rioconcho and Dev soils. These soils make up less than 10 percent of the total area of this mapping unit.

About 50 percent of the acreage of this soil is used for crops, and 50 percent is used as range. Cotton and grain sorghum are the major crops.

The main concern in the management of this soil is the maintenance of tilth. The management of residue helps to maintain tilth. In areas where this soil is irrigated, an irrigation system that controls loss of water is needed. Dryland capability unit IIIc–1 and irrigated capability unit I–1; Clay Loam range site.

Angelo silty clay, 1 to 3 percent slopes (AoB).—This soil is in valleys in areas of limestone. The slope is dominantly 1 to 2 percent.

The surface layer of this soil is dark-brown silty clay about 6 inches thick. The next layer extends to a depth of 60 inches or more. The upper 7 inches is brown silty clay loam, the next 22 inches is reddish-brown clay, and the lower 25 inches is reddish-yellow silty clay loam.

Included with this soil in mapping are areas of an Angelo clay loam and of Rioconcho soils. These areas make up less than 5 percent of the total area of this mapping unit.

About 50 percent of the acreage of this soil is used for crops, and 50 percent is used as range. Cotton and grain sorghum are the main crops.

The main concerns in the management of this soil are the control of water erosion and the maintenance of tilth. Terraces and contour farming help to control water erosion, and crop residue helps to maintain tilth. Diversion terraces and grassed waterways are needed in places to control water from adjacent areas. In areas where this soil is irrigated, an irrigation system that controls loss of soil and water is needed. Dryland capability unit IIIe–1 and irrigated capability unit IIe–1; Clay Loam range site.

Angelo-Urban land complex, 0 to 3 percent slopes (AuB).—This complex consists of about 60 percent Angelo clay loam and 40 percent Urban land. The percentage of Urban land ranges from 20 to 50 percent. These areas are so intermingled or so small in size that they cannot be shown separately at the scale mapped.

The surface layer of the Angelo clay loam is grayish-brown clay loam about 7 inches thick. The next layer extends to a depth of 60 inches or more. The upper 8 inches of this layer is brown clay loam, the next 14 inches is reddish-brown clay, and the lower 31 inches is pink silty clay loam.

The Urban land is made up of streets, single-unit dwellings, driveways, sidewalks, business buildings, schools, churches, and parking lots. Before urban development, these areas were dominantly Angelo soils. The soils in these areas have been so altered by urban works, structures, and earthmoving that their identification is not possible.

The corrosivity of the Angelo soils to uncoated steel is moderate to high. The shrink-swell potential is high. The shrink-swell properties of these soils made it necessary to have unusually strong foundations for buildings, streets, or other structures.

The Angelo soils are well suited to most of the common landscaping plants used in the survey area. Not placed in capability unit or range site.

Berda Series

The Berda series consists of gently sloping to sloping soils at the base of steep limestone hills. These soils formed partly in material of Cretaceous and Permian age.

In a representative profile the surface layer is pale-brown loam about 10 inches thick. The next layer is

about 30 inches thick. The upper 8 inches is pale-brown loam, and the lower 22 inches is light-brown clay loam. The underlying material is pink clay loam that extends to a depth of 60 inches.

Berda soils are well drained and have medium surface runoff. Permeability is moderate. Available water capacity is high.

These soils are better suited to range than to most other uses because of their slopes.

Representative profile of Berda loam, 3 to 8 percent slopes, 6.5 miles west from the courthouse in San Angelo on U.S. Highway 67, then 0.3 mile south and 150 yards from the base of a steep hill in an area of range:

A1—0 to 10 inches, pale-brown (10YR 6/3)) loam, dark brown (10YR 4/3) moist; weak, fine, granular structure and weak, fine, subangular blocky; slightly hard, friable; on the surface is a 5 percent cover of limestone fragments ranging from ⅛ to ½ inch in size; calcareous; moderately alkaline; clear, wavy boundary.

B2—10 to 18 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak, fine, granular structure and weak, fine, subangular blocky; hard, friable; few pores; common threads of calcium carbonate; common worm casts; calcareous; moderately alkaline; gradual, wavy boundary.

B2ca—18 to 40 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; weak, fine, subangular blocky structure; hard, firm; common threads of calcium carbonate; common worm casts; about 5 percent calcium carbonate concretions ⅛ to ¼ inch in size; calcareous; moderately alkaline; diffuse, wavy boundary.

Cca—40 to 60 inches, pink (7.5YR 7/4) clay loam, light brown (7.5YR 6/4) moist; about 3 percent is calcium carbonate concretions and soft aggregates; calcareous; moderately alkaline.

The A horizon ranges from 6 to 12 inches in thickness and is brown, reddish brown, or pale brown in color. It is 2 to 5 percent limestone and hard caliche fragments and siliceous pebbles.

The B horizon is 18 to 30 inches thick and is loam, clay loam, and sandy clay loam. It is pink, pale brown, or light brown. In places, the B horizon is, by volume, 3 to 10 percent calcium carbonate concretions or soft aggregates.

The weak Cca horizon, where present, has less than 5 percent calcium carbonate in the form of concretions or soft aggregates.

Berda loam, 3 to 8 percent slopes (BeD).—This soil is at the base of steep limestone hills. Slopes vary over short distances. The slopes at higher elevations typically are steeper than the slopes at lower elevations.

Included with this soil in mapping are small areas of Tulia soils. These soils make up about 10 percent of the total area of this mapping unit. Also included are areas of soils that have gravelly or more sandy overwash at the surface and areas of soils that have a few gullies.

The hazard of water erosion is severe, and the hazard of soil blowing is slight.

This soil is used as range. It is not well suited to crops. Dryland capability unit IVe–2; Hardland Slopes range site.

Cobb Series

The Cobb series consists of gently sloping soils on hilltops and side slopes. These soils formed in loamy material weathered from sandstone.

In a representative profile the surface layer is brown fine sandy loam about 8 inches thick. The next layer extends to a depth of 28 inches. The upper 17 inches is reddish-brown sandy clay loam, and the lower 3 inches is sandstone and sandy clay loam. The underlying material is yellow sandstone.

These soils are well drained and have rapid surface runoff. Permeability is moderate. Available water capacity is medium.

These soils are suited to crops and to use as range and wildlife habitat.

Representative profile of Cobb fine sandy loam, 1 to 3 percent slopes, 0.6 mile south of the Coke-Tom Green County line along U.S. Highway 277 and then 100 feet east in an area of range:

A1—0 to 8 inches, brown (7.5YR 4/4) fine sandy loam, reddish brown (5YR 4/3) moist; weak, coarse, prismatic structure parting to weak, fine, subangular blocky and weak, fine, granular; soft, very friable; neutral; clear, smooth boundary; thin surface crust.

B21t—8 to 20 inches, reddish-brown (5YR 4/3) sandy clay loam, dark reddish brown (5YR 3/3) moist; weak, coarse, prismatic structure parting to weak, fine, subangular blocky; very hard, friable; clay films on most peds; mildly alkaline; gradual, wavy boundary.

B22t—20 to 25 inches, reddish-brown (5YR 4/4) sandy clay loam, reddish brown (5YR 4/3) moist; weak, coarse, prismatic structure and weak, fine, subangular blocky; very hard, friable; clay films on most peds; few worm casts; noncalcareous; moderately alkaline; clear, wavy boundary.

B23&C—25 to 28 inches, equal parts of yellow sandstone and sandy clay loam in a platy arrangement; noncalcareous; moderately alkaline; abrupt, wavy boundary.

C—28 to 30 inches, noncalcareous, yellow sandstone.

The solum ranges from 20 to 40 inches in thickness. It is underlain by fine-grained, red and yellow sandstone. The A horizon is 6 to 14 inches thick. It is reddish brown, light brown, or brown. Reaction is slightly acid to moderately alkaline.

The B2t horizon is 14 to 32 inches thick. It is reddish brown, red, light red, or light reddish brown. It has weak to strong, fine to medium, subangular blocky structure. Reaction is neutral to moderately alkaline. In places, there is a Bca horizon just above the sandstone, but it is less than 6 inches thick. In places, the lower part of the profile is gravelly or very gravelly.

Cobb fine sandy loam, 1 to 3 percent slopes (CoB).—This soil has smooth, convex and concave slopes.

Included with this soil in mapping are small areas of Cosh soils and a similar soil that has 15 to 50 percent quartzitic pebbles. These soils make up about 10 percent of the total area of this mapping unit.

Almost all of the acreage of this soil is in range, and there are many kinds of vegetation. This soil is well suited to use as wildlife habitat, because oaks and other woody plants that supply cover, browse, and mast grow on it. It is suited to many kinds of crops.

The hazards of soil blowing and water erosion are moderate. The main concerns in management are controlling erosion and maintaining good tilth. Terraces and contour farming help to control water erosion, and leaving crop residue on the surface helps to control soil blowing and to improve tilth. In places, diversion terraces and grassed waterways are needed to control runoff from other soils. If this soil is irrigated,

a system that controls loss of water is needed. Dryland capability unit IIIe–2 and irrigated capability unit IIe–2; Sandy Loam range site.

Cosh Series

The Cosh series consists of gently sloping to sloping soils on hilltops and side slopes near sandstone outcrops. These soils formed in loamy sediment weathered from sandstone.

In a representative profile the surface layer is reddish-brown fine sandy loam about 5 inches thick. The next layer is reddish-brown sandy clay loam about 13 inches thick. The underlying material is sandstone.

Cosh soils are well drained and have rapid surface runoff. Permeability is moderate. Available water capacity is low.

These soils are better suited to use as range and wildlife habitat than to most other uses.

Representative profile of a Cosh fine sandy loam in an area of Cosh-Latom complex, 1 to 8 percent slopes, 11.9 miles north of the courthouse in San Angelo along U.S. Highway 277 and then 1.2 miles east in an area of range:

A1—0 to 5 inches, reddish-brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak, fine, granular structure and weak, fine, subangular blocky; slightly hard, vary friable; 5 percent rounded quartzitic pebbles 1/16 to 1 inch thick, surface crust is 1/4-inch thick; neutral; clear, wavy boundary.

B21t—5 to 13 inches, reddish-brown (2.5YR 4/4) sandy clay loam, dark reddish brown (2.5YR 3/4) moist; moderate, fine and medium, subangular blocky structure; very hard, firm; few tubes and pores; contains 5 percent rounded quartzitic gravel 1/16 to 1 inch thick; clay films on all peds; common earthworm casts; neutral; gradual, wavy boundary.

B22t—13 to 18 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (2.5YR 3/4) moist; weak, fine, subangular blocky structure; very hard, firm; few pores; many earthworm casts; clay films on all peds; 5 percent rounded quartzitic gravel 1/16 to 1 inch thick; neutral; abrupt, wavy boundary.

C—18 inches, yellow (10YR 7/6) sandstone, strong brown (7.5YR 5/6) moist; neutral.

The solum ranges from 12 to 20 inches in thickness. The A horizon is 4 to 10 inches thick. It is brown or reddish brown. Reaction is slightly acid to neutral.

The Bt horizon ranges from sandy clay loam to gravelly sandy clay loam and is 18 to 35 percent clay. It is reddish brown, red, or weak red. It ranges from 6 to 13 inches in thickness. Reaction is neutral to mildly alkaline.

Cosh-Latom complex, 1 to 8 percent slopes (CsD).—This complex consists of about 42 percent Cosh fine sandy loam, 20 percent Latom fine sandy loam, and 38 percent included soils. The Cosh soils make up 30 to 80 percent of areas of the complex. Slopes are dominantly about 6 percent. Areas of this complex are so intermingled or so small in size that they cannot be shown separately at the scale mapped. The soils in this complex mostly formed in material derived from sandstone and red marine clays and material derived from conglomerates from the San Angelo Formation. Coarse fragments of all sizes are abundant near sandstone outcrops. Vegetation grows throughout the areas of outcrops in cracks in the sandstone that are filled with soil. Areas bare of vegetation are covered by stones or boulders. Latom soils are in areas near sandstone outcrops.

Cosh soils commonly are less sloping than Latom soils and are in areas between or around the sandstone outcrops. Some Cosh soils are more nearly level and occur on the tops of hills, and some formed in deep alluvium.

Included with this complex in mapping are areas of soils that are similar to Cosh soils but that are more than 35 percent gravel. These soils make up 11 percent of the total area of this mapping unit. Also included are areas of soils that are more than 35 percent gravel but are otherwise similar to Latom soils. They make up 6 percent of this mapping unit. Also included are areas of soils similar to Latom soils but that are noncalcareous. They make up 10 percent of this mapping unit. Areas of Cobb soils make up 6 percent, and areas of Kimbrough and Owens soils make up 5 percent. There are areas of a soil that has slopes of as much as 20 percent.

The hazards of water erosion and soil blowing are moderate.

Areas of these soils are in range. These soils are well suited to wildlife habitat. Many kinds of vegetation, including woody plants, grow on them. Dryland capability unit VIe–1; Sandstone Hill range site.

Dev Series

The Dev series consists of nearly level to gently sloping soils on flood plains of streams that drain limestone areas.

In a representative profile the surface layer is very gravelly clay loam about 24 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The underlying material is brown very gravelly clay loam that extends to a depth of 86 inches.

Dev soils are well drained and have slow to medium surface runoff. Permeability is moderately rapid. Available water capacity is medium.

These soils are better suited to use as range and wildlife habitat than to most other uses.

Representative profile of a Dev very gravelly clay loam in an area of Dev and Rioconcho soils, 1.4 miles north of the Tom Green-Schleicher County line along U.S. Highway 277 and then 3.8 miles east in an area of rangeland:

A11—0 to 12 inches, dark grayish-brown (10YR 4/2) very gravelly clay loam, very dark brown (10YR 2/2) moist; moderate, very fine and fine, granular structure and weak, fine, subangular blocky; hard, firm; 80 percent rounded limestone gravel and cobblestones 1/16 inch to 5 inches in diameter; calcareous; moderately alkaline; gradual, wavy boundary.

A12—12 to 24 inches, grayish-brown (10YR 5/2) very gravelly clay loam, very dark brown (10YR 2/2) moist; weak, very fine and fine, granular structure and weak, medium, subangular blocky; hard, firm; 70 percent rounded limestone gravel and cobblestones 1/16 inch to 5 inches in diameter; calcareous; moderately alkaline; gradual, wavy boundary.

C—24 to 86 inches, brown (10YR 5/3) very gravelly clay loam, dark brown (10YR 3/3) moist; weak, fine,

subangular blocky structure; hard, firm; common roots; 80 percent rounded limestone gravel and cobblestones, one-half of which are less than ¼ inch in diameter, common threads of calcium carbonate; calcareous; moderately alkaline.

Depth to bedrock ranges from 48 inches to more than 100 inches. Content of gravel ranges from 35 to 85 percent, nearly all of which is rounded limestone and chert. Most of this gravel is less than 3 inches in diameter, but a few cobblestones and stones are present. The texture of the fines ranges from loam to clay loam, but clay loam is dominant.

The A1 horizon ranges from 20 to 36 inches in thickness. It is grayish brown, dark grayish brown, or very dark grayish brown. Below the A1 horizon, the color is brown or grayish brown.

Dev and Rioconcho soils (Dr).—These soils commonly are in long, narrow areas that parallel the intermittent streams that drain the areas of limestone in the county. The slope generally ranges from 0 to 3 percent. In areas where there are secondary stream channels, the soils are undulating.

This undifferentiated group is 45 percent Dev very gravelly clay loam, 35 percent Rioconcho clay loam, 10 percent stream channels, and 10 percent other soils. The pattern of the soils is not uniform and occurs without regularity. Some areas are mainly Dev soils, and other areas are Rioconcho and Dev soils.

Dev soils are adjacent to the stream channels. Generally, they are on a level a few feet above the stream channel and are subject to flooding from once in 2 years to several times a year.

Rioconcho soils have a surface layer of dark-brown clay loam about 34 inches thick. The next layer is grayish-brown clay loam that extends to a depth of 60 inches. These soils are adjacent to the Dev soils and, in some places, they are adjacent to the stream channel. They are on a level slightly above that of the Dev soils. They are flooded about once in 2 years. The flooding lasts less than a day.

The stream channels are mostly limestone rubble. The vegetation is widely scattered grasses and a few trees. In places, nearly solid limestone bedrock is at the surface. The small amount of soil present is mostly recent stratified sediment.

Included with these soils in mapping are small areas of Angelo, Ector, and Tarrant soils. These soils make up about 10 percent of the total area mapped. Also included are some steep streambanks.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate. These soils are not suited to crops, because of the hazard of flooding and because of the high gravel content of some areas of the soils. They are mostly used as range. Dryland capability unit VIw-1; Bottom Land range site.

Ector Series

The Ector series consists of undulating to hilly soils that are underlain by limestone.

In a representative profile the surface layer is grayish-brown very gravelly clay loam about 8 inches thick. It is underlain by hard, caliche-coated limestone. Most cracks in the limestone are sealed.

Ector soils are well drained, and surface runoff is rapid. Permeability is moderate. Available water capacity is low.

These soils are better suited to use as range and wildlife habitat than to most other uses.

Representative profile of Ector very gravelly clay loam in an area of Ector association, undulating, 9.7 miles along Ranch Road 2084 east of the intersection of U.S. Highway 277 and Ranch Road 2084 in Christoval and then 150 feet north in an area of rangeland:

A1—0 to 5 inches, grayish-brown (10YR 5/2) very gravelly clay loam, very dark grayish brown (10YR 3/2) moist; moderate, fine and very fine, granular structure and weak, fine, subangular blocky; slightly hard, firm; limestone and caliche fragments cover 30 percent of the surface and make up 50 percent of the horizon; calcareous; moderately alkaline; clear, wavy boundary.

A1ca—5 to 8 inches, grayish-brown (10YR 5/2) very gravelly clay loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure and weak, fine, subangular blocky; slightly redder and has slightly higher chroma than shown above; 80 percent caliche-coated limestone or caliche nodules 1 to 2 inches thick and 2 to 7 inches across; coatings are ¼ to 1 inch thick, have a hardness of less than 3 on Moh's scale, and are smooth on top and rough on the bottom; calcareous; moderately alkaline; abrupt, wavy boundary.

R—8 to 9 inches, fractured limestone that has most cracks sealed with hard caliche.

The solum ranges from 4 to 20 inches in thickness. Content of coarse fragments ranges from 40 to 80 percent. Coarse fragments consist of hard caliche nodules and plates and caliche-coated limestone. They range in size from fine gravel to plates 10 inches wide, but most are less than 1 inch wide. The texture of the fine materials ranges from loam and silt loam to clay loam. Clay content ranges from 25 to 35 percent. Color ranges from grayish brown to dark grayish brown. Most of the cracks in the underlying limestone are sealed by coatings of indurated caliche ¼ inch to 1 inch thick.

Ector association, undulating (EcC).—These soils are in areas of limestone bedrock. They commonly are on the convex sides of low, rounded hills and on the tops of steeper hills. The slope is 1 to 8 percent. The areas of these soils are large and irregularly shaped. Areas of this mapping unit are much larger than those of other mapping units in the county, and their composition is more variable. The mapping of these areas, however, has been well enough controlled for their anticipated use. These areas could be separated in mapping, but their use and management are similar and separation is not justified.

This association is 60 percent Ector very gravelly clay loam, 17 percent Ector very gravelly silt loam, 17 percent Ector very gravelly loam, and 6 percent other soils. Ector very gravelly clay loam has the profile described as representative of the series.

Included with these soils in mapping are areas of soils that are nongravelly, of soils that are stony, and of Tarrant soils. Also included is a lighter colored soil.

All of these soils are used as range. Dryland capability unit VIIs-2; Shallow Hills range site.

Ector association, hilly (EcE).—These soils are in areas of limestone bedrock. They are on the sides of steep hills. The slopes range from 10 to 30 percent. The areas of these soils are large and irregularly shaped. Stones are on the surface in some areas. Limestone rock outcrops typically are in some areas near the top of the hills. Areas of this mapping unit are

much larger than those of other mapping units in the county, and their composition is more variable. The mapping of these areas, however, has been well enough controlled for their anticipated use. These areas could be separated in mapping, but their use and management are similar and separation is not justified.

This association is 45 percent Ector very gravelly clay loam, 20 percent Ector very gravelly silt loam, and 20 percent Ector very gravelly silty clay loam, and 15 percent included soils.

The surface layer commonly is dark grayish-brown very gravelly clay loam about 6 inches thick. The underlying material is fractured limestone.

Included with these soils in mapping are areas of similar but lighter colored soils that make up about 10 percent of the total area of this mapping unit. Also included are Ector soils that have slopes of less than 10 percent and that make up about 5 percent of the area, and Ector soils that have slopes of 30 to 50 percent.

All of these soils are used as range and wildlife habitat. They are not suited to crops. Dryland capability unit VIIs–2; Shallow Hills range site.

Estacado Series

The Estacado series consists of nearly level to gently sloping soils on outwash plains.

In a representative profile the surface layer is dark-brown loam about 16 inches thick. The next layer extends to a depth of 80 inches. The upper 28 inches is brown loam, and the lower 36 inches is light-brown and pink clay loam.

Estacado soils are well drained and have slow surface runoff. Permeability is moderate. Available water capacity is high.

These soils are suited to crops and to use as range and wildlife habitat.

Representative profile of Estacado loam, 1 to 3 percent slopes, 15.5 miles west of the courthouse in San Angelo along Ranch Road 853, and then 125 yards south in an area of rangeland:

A1—0 to 16 inches, dark-brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak, fine, subangular blocky structure and weak, coarse, prismatic; friable, hard; many roots, few fine pores; 5 percent worm casts; calcareous; moderately alkaline; gradual, wavy boundary.

B21ca—16 to 44 inches brown (75YR 5/4) loam, brown (7.5YR 4/4) moist; weak, medium, subangular blocky structure and weak, coarse, prismatic; hard, friable; many roots, few fine pores; common worm casts; few calcareous pebbles ⅛ to ½ inch in diameter, few to common threads of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

B22tca—44 to 54 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; weak, fine, subangular blocky structure; hard, friable; few concretions of calcium carbonate ⅛ to ¼ inch in diameter; calcareous; moderately alkaline; clear, wavy boundary.

B23tca—54 to 62 inches, pink (5YR 8/3) clay loam, light reddish yellow (5YR 6/4) moist; weak, medium, subangular blocky structure; hard, friable; about 30 percent visible calcium carbonate including about 2 percent calcium carbonate concretions ⅛ to ½ inch in diameter; calcareous; moderately alkaline; gradual, wavy boundary.

B24tca—62 to 80 inches, pink (5YR 8/3 clay loam, light reddish yellow (5YR 6/4) moist; weak, medium, subangular blocky structure; hard, firm; much less visible calcium carbonate than in horizon above; calcareous; moderately alkaline.

The A horizon ranges from 9 to 16 inches in thickness and is brown, dark brown, or dark grayish brown in color.

The B horizon ranges from 50 inches to more than 80 inches in thickness. It is brown, strong-brown, light-brown, pink, reddish-yellow, and reddish-brown loam sandy clay loam, or clay loam. Content of calcium carbonate ranges from 20 to 50 percent and from a few concretions to weakly cemented caliche plates that have soil around them.

Estacado loam, 0 to 1 percent slopes (EsA).—This soil is on valley floors. Mapped areas are 5 to 60 acres in size and are irregularly shaped.

The surface layer of this soil is brown loam about 15 inches thick. The next layer is brown clay loam about 30 inches thick. The underlying material is pink clay loam that extends to a depth of 60 inches.

Included with this soil in mapping are areas of Tulia soils that make up about 15 percent of the total area of this mapping unit. Also included are areas of Berda soils that make up about 5 percent, and Angelo soils that make up 5 percent.

Most of the acreage of this soil is used as range. This soil is suited to cultivation and can be used for all crops commonly grown in the county.

The hazard of water erosion is slight, and the hazard of soil blowing is moderate. The main concerns in management are control of soil blowing and maintenance of tilth. Good management of crop residue helps to control soil blowing and to maintain tilth. Diversion terraces and grassed waterways are needed in places to control runoff from other soils. If this soil is irrigated, a system that controls loss of soil and water is needed. Dryland capability unit IIIe–3; Hardland Slopes range site.

Estacado loam, 1 to 3 percent slopes (EsB).—This soil is on long foot slopes or valley floors. Mapped areas are 5 to 60 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Tulia soils that make up about 15 percent of the total area of this mapping unit. Also included are areas of Berda soils that make up 5 percent, and areas of Angelo soils that make up 5 percent.

Almost all of the acreage of this soil is in range. The soil is well suited to cultivation and can be used for all the crops commonly grown in the county.

The hazards of soil blowing and water erosion are moderate. The main concerns in management are controlling soil blowing and water erosion and maintaining tilth. Terraces and contour farming help to control water erosion, and leaving crop residue on the surface helps to control soil blowing and to maintain tilth. Diversion terraces and grassed waterways are needed in places to control water from higher lying soils. If this soil is irrigated, a system that controls loss of soil and water is needed. Dryland capability unit IIIe–2; Hardland Slopes range site.

Kavett Series

The Kavett series consists of nearly level to gently sloping soils that are underlain by limestone.

In a representative profile the surface layer is clay about 17 inches thick. It is very dark grayish brown in the upper 7 inches and dark grayish brown in the lower 10 inches. Below this layer is indurated caliche and hard limestone.

Kavett soils are well drained and have slow surface runoff. Permeability is moderately slow. Available water capacity is low.

These soils are better suited to use as range and wildlife habitat than to most other uses.

Representative profile of Kavett clay, 0 to 1 percent slopes, 12.5 miles south of the courthouse in San Angelo along U.S. Highway 277, 8.0 miles southeast along Door Key Lane, and 250 feet north in an area of rangeland:

A11—0 to 7 inches, very dark grayish-brown (10YR 3/2) clay, very dark brown (10YR 2/2) moist; moderate, fine, granular structure and moderate, medium, subangular blocky; very hard, very firm; few limestone or caliche fragments 1/16 to 1 inch in diameter; calcareous; moderately alkaline; clear, wavy boundary.

A12—7 to 17 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; weak, coarse, prismatic structure parting to moderate, very fine, subangular blocky; extremely hard, firm; few limestone or caliche fragments 1/16 to 1 inch in diameter; 50 percent calcium carbonate concretions about 1 to 2 inches thick and 1 to 6 inches wide in the lower 2 inches; calcareous, moderately alkaline; abrupt, wavy boundary.

Ccam—17 to 19 inches, white (10YR 8/2) indurated caliche, very pale brown (10YR 7/4) moist, the upper part is the hardest and is laminar; thickness ranges from 1 inch to 5 inches in crevices of the underlying limestone; calcareous; moderately alkaline; abrupt, wavy boundary.

R—19 to 20 inches, hard limestone.

The solum ranges from 10 to 20 inches in thickness. It is underlain by a hard caliche layer over limestone. The solum is dark grayish brown, very dark grayish brown, dark brown, or grayish brown. The indurated caliche layer is continuous and is ¼ inch to 2 inches thick. In most places platy concretions are on top of the continuous layer. The plates are ¼ inch to 3 inches thick and 1 inch to 12 inches wide.

Kavett clay, 0 to 1 percent slopes (KaA).—This soil is on divides between the drainageways or on valley floors. Areas of this soil mostly are less than 60 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Angelo, Tarrant, or Ector soils. They make up less than 5 percent of the total area of this mapping unit.

This soil is suited to crops, but most of it is used as range. Small grain for grazing is the main crop.

The hazards of soil blowing and water erosion are slight. This soil has a shallow rooting zone and is droughtly. The main concern in management is maintenance of tilth. Good management of crop residue helps to maintain tilth. If this soil is irrigated, a system that controls loss of soil and water is needed. Dryland capability unit IIIs–1 and irrigated capability unit IIs–2; Shallow range site.

Kavett clay, 1 to 3 percent slopes (KaB).—This soil is in valleys, on sides and tops of hills and on divides. The areas of this soil average about 20 acres in size.

The surface layer is very dark grayish-brown clay about 15 inches thick. The underlying material is indurated caliche and hard limestone.

Included with this soil in mapping are areas of Angelo, Tarrant, and Ector soils. These soils make up about 10 percent of the total area of this mapping unit.

Nearly all the acreage of this soil is in range. The most common crop in a few small fields is small grain for grazing.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate. Kavett soils have a shallow rooting zone and are droughty. The main concerns of management are controlling water erosion and maintaining good tilth. Terraces and contour farming help to control water erosion. Diversion terraces and grassed waterways are needed in places to control runoff from higher lying soils. Leaving crop residue on the surface helps to maintain tilth. If this soil is irrigated, a system that controls loss of soil and water is needed. Dryland capability unit IIIe–4 and irrigated capability unit IIIe–2; Shallow range site.

Kimbrough Series

The Kimbrough series consists of gently sloping to sloping and undulating soils on outwash plains.

In a representative profile the surface layer is grayish-brown gravelly loam about 9 inches thick. The next layer is white, indurated caliche about 6 inches thick. Below the indurated caliche is pink caliche that extends to a depth of 72 inches. The pink caliche is underlain by pinkish-white loam that extends to a depth of 90 inches.

Kimbrough soils are well drained, and surface runoff is medium. Permeability is moderate. Available water capacity is low.

These soils are not suited to crops. They are mostly used as range and wildlife habitat.

Representative profile of Kimbrough gravelly loam in an area of Kimbrough association, undulating, 17.0 miles east of the courthouse in San Angelo along Farm Road 380, 6.0 miles north along Farm Road 1692, 0.5 mile west along a county road, and 450 feet north in an area of rangeland:

A1—0 to 9 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, granular structure and moderate, fine, subangular blocky; hard, firm; many roots; 25 percent hard caliche fragments and siliceous pebbles ¼ to 1 inch in diameter, 40 percent of the surface is covered with these fragments; calcareous; moderately alkaline; abrupt, wavy boundary.

Ccam—9 to 15 inches, white (10YR 8/2) indurated caliche, very pale brown (10YR 7/3) moist; three layers of indurated caliche (the lower one is the hardest, and softer caliche is between the layers); no roots below a depth of 13 inches; calcareous; moderately alkaline; clear, wavy boundary.

Cca—15 to 72 inches, pink (7.5YR 7/4) caliche, pinkish white (7.5YR 8/2) moist, 60 percent calcium carbonate; calcareous; moderately alkaline; diffuse, wavy boundary.

C—72 to 90 inches, pinkish-white (7.5YR 8/2) caliche of loam texture, pink (7.5YR 7/4) moist; cubical rock structure.

The A horizon ranges from 4 to 15 inches in thickness. It ranges from loam or gravelly loam to gravelly clay

loam. The content of clay is 18 to 35 percent, and the content of coarse fragments is 10 to 35 percent. The gravel is hard caliche, limestone, chert, flint, and rounded quartzitic pebbles, most of which are less than 1½ inches in diameter. The A horizon is dark grayish brown, dark brown, brown, or grayish brown.

The Ccam horizon ranges from 1 to 18 inches in thickness. It is mostly platy, but a small part is massive. The plates are indurated and laminar on top and rough and knobby on the bottom. They are ½ inch to 2 inches thick and 3 to 18 inches wide. Thin seams of soil material that has many worm casts and roots are between the upper plates in places.

Kimbrough association, undulating (KmC).—These soils have convex slopes and are near narrow drainageways. Slopes are 1 to 8 percent.

Kimbrough gravelly loam makes up about 60 percent of the total area of this mapping unit; Kimbrough gravelly clay loam, 20 percent; Kimbrough loam, 10 percent; and included soils, 10 percent. Mapped areas of these soils are much larger and more variable in composition than are other mapped areas in the county. The soils could be mapped separately, but because use and management are similar, this is not justified. Mapping has been controlled well enough for the anticipated use of the areas.

A soil in this association has the profile described as representative of the series (fig. 4).

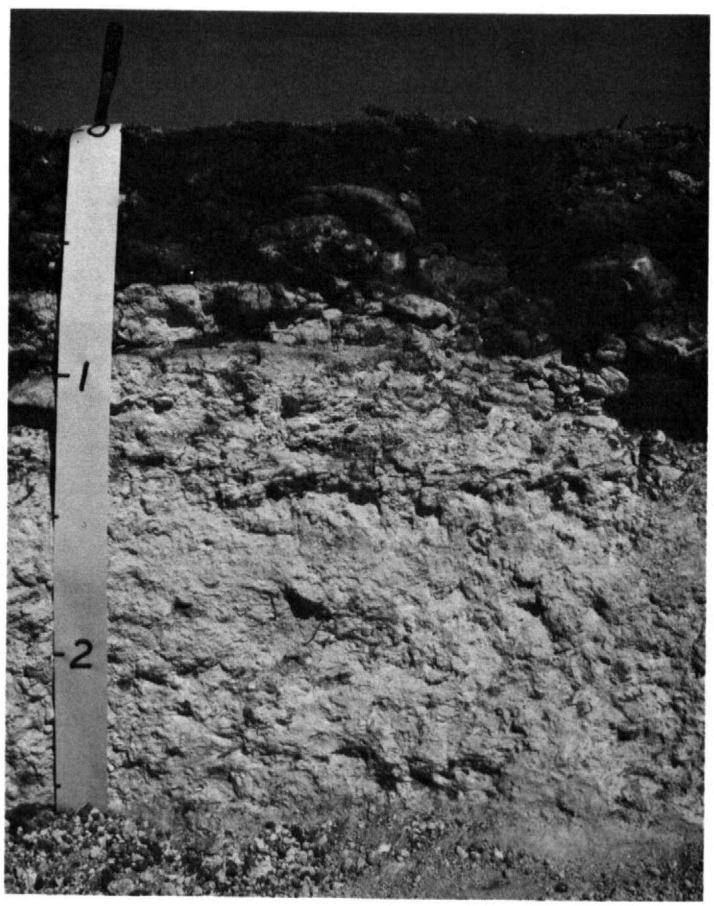

***Figure 4.*—Profile of a Kimbrough gravelly loam that has indurated caliche.**

Included with these soils in mapping are areas of Kimbrough soils that are less than 4 inches deep, areas of soils that have a soft and cracked, or discontinuous, layer of cemented caliche, and areas that are very gravelly clay loam. Also included are areas of Kimbrough soils that have slopes of 8 to 20 percent.

Most of the acreage of these soils is in range. The hazards of soil blowing and water erosion are slight. Dryland capability units VIIs–1; Very Shallow range site.

Kimbrough-Owens complex, 1 to 8 percent slopes (KoD).—This complex consists of 55 percent Kimbrough gravelly loam, 25 percent Owens clay, and 20 percent other soils. The Kimbrough soil typically is on tops of low hills and ridges, and the Owens soil is on the sides of hills. Slopes are convex (fig. 5). Areas of Kimbrough and Owens soils are so intermingled or so small in size that they cannot be shown separately at the scale mapped.

The surface layer of the Kimbrough soil is dark-brown gravelly loam about 8 inches thick. The underlying material is white, indurated caliche.

Included with this complex in mapping are areas of Berda soils and of colluvial deposits in drainageways. These included areas make up about 10 percent of the total area of this mapping unit. Also included are areas of soils that are light-colored loam less than 4 inches deep to soft caliche, which make up about 10 percent of mapped areas, and some areas of soils that have slopes of less than 1 percent and slopes of 8 to 20 percent.

The hazard of soil blowing is slight. The hazard of water erosion is moderate.

All of the acreage of these soils is used as range. Both soils in dryland capability unit VIIs–1; Kimbrough soils in Very Shallow range site, and Owens soils in Shallow Clay range site.

Kimbrough-Urban land complex, 1 to 8 percent slopes (KuD).—This complex consists of areas of Kimbrough soils and Urban land on ridges and foot slopes. It is 65 percent Kimbrough gravelly loam, 30 percent Urban land, and 5 percent other soils. Urban

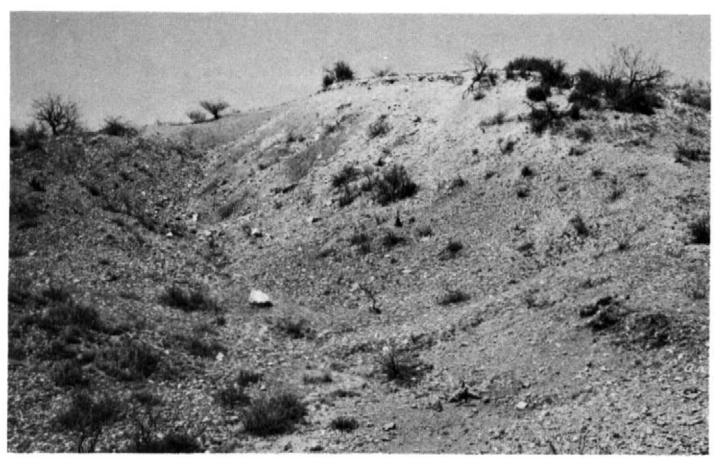

***Figure 5.*—Kimbrough-Owens complex, 1 to 8 percent slopes. The Kimbrough soils are on the top of the hill, and the Owens soils are on the sides.**

land makes up 15 to 55 percent of mapped areas. Areas of this complex are so intermingled or so small in size that they cannot be shown separately at the scale mapped.

The surface layer of the Kimbrough soil is dark grayish-brown gravelly loam about 12 inches thick. The underlying material is white, indurated caliche.

Urban land is made up of single unit dwellings, streets, driveways, sidewalks, business buildings, schools, churches, and parking lots. Before urban development, these areas were dominantly Kimbrough soils. The soils in these areas have been so altered by urban works, construction, and earthmoving that identification is not practical.

Most areas of the soils that have slopes of less than 2 percent have not been cut and shaped during urbanization, but the more sloping areas have been cut to a depth of as much as 6 feet, and the excavated material has been spread over the adjoining natural surface. These shaped areas, where used for lawns, have been covered with 2 to 10 inches of imported soil material.

Corrosivity of these soils to uncoated steel is high. Kimbrough soils have hard caliche layers that are difficult to excavate. These very shallow to shallow soils are not well suited to landscaping. Not placed in a capability unit or range site.

Latom Series

The Latom series consists of gently sloping to sloping soils near sandstone outcrops. They formed in loamy sediment weathered from sandstone or conglomerate.

In a representative profile the surface layer is brown calcareous fine sandy loam about 12 inches thick. It is underlain by sandstone or conglomerate.

Latom soils are moderately well drained and have slow surface runoff. Permeability is slow below the surface layer. Available water capacity is low.

All of the acreage of these soils is used as range and wildlife habitat.

These soils are mapped only in a complex with Cosh soils.

Representative profile of Latom fine sandy loam in an area of Cosh-Latom complex, 1 to 8 percent slopes, 5.2 miles west of San Angelo on U.S. Highway 67, 0.4 mile north along Ranch Road 2288, and then 350 yards east in an area of rangeland:

A1—0 to 12 inches, brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak, fine, granular structure and weak, fine, subangular blocky; loose, very friable; few roots; in the lower 2 inches, 40 percent platy sandstone fragments that have a thin coating of calcium carbonate; few earthworm casts; calcareous; moderately alkaline; abrupt, smooth boundary.

R—12 to 16 inches, pale-yellow (2.5Y 7/4) sandstone, light yellowish brown (2.5Y 6/4) moist; can be cut with a spade with difficulty; calcareous; moderately alkaline.

The A horizon ranges from 4 to 15 inches in thickness. It is brown, reddish brown, light brown, or pale brown. In most places there are few to common sandstone fragments and rounded siliceous pebbles on the surface. In about 30 percent of the areas of these soils, these fragments and pebbles are throughout the profile. In places, all the coarse fragments have a thin coating of calcium carbonate, and weakly cemented calcium carbonate is in the fractures of the underlying sandstone. In other places, no calcium carbonate is visible. All profiles are calcareous and moderately alkaline.

Lipan Series

The Lipan series consists of nearly level soils in depressional areas that pond water after rainfall.

In a representative profile the surface layer is gray clay about 18 inches thick. The next layer is light brownish-gray clay about 30 inches thick. The underlying material is an accumulation of calcium carbonate and pink clay.

Lipan soils are moderately well drained and have slow surface runoff. If these soils are dry and cracked, water enters them rapidly, but permeability is very slow after the cracks have closed. Available water capacity is high.

These soils are suited to crops, but to obtain consistently good production of crops, some means of controlling excess water is needed. Ponding generally can be controlled by terracing the adjacent soils. In areas used as range, forage yields are often reduced by ponding. Structures and roads on these soils need strong foundations because of the high shrink-swell potential.

Representative profile of Lipan clay, 7.2 miles southeast of the courthouse in San Angelo along U.S. Highway 87, 1.0 mile southeast along Ranch Road 1223, 0.9 mile south along a county road, and 30 yards west in a cropped field:

Ap—0 to 6 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; weak, fine, blocky structure, upper 2 inches forms a mulch of very hard, very fine, angular peds; very hard, very firm, very sticky and very plastic; many roots; few siliceous pebbles, mostly less than ¼ inch in diameter; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—6 to 18 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate, very fine and fine, blocky structure; very hard, very firm, very sticky and plastic; many roots; peds have shiny pressure faces; few siliceous pebbles, mostly less than ¼ inch in diameter; calcareous; moderately alkaline; gradual, wavy boundary.

AC—18 to 48 inches, light brownish-gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; very few, fine, distinct, strong-brown mottles; weak, medium, blocky structure; wedge-shaped peds ¼ to ½ inch long and grooved slickensides extend downward from a depth of 28 inches; slickensides intersect, are at least 3 inches across, and become more strongly expressed with increasing depth; very hard, very firm very sticky and very plastic; few fine roots penetrate the peds; evident shiny pressure faces on peds; few siliceous pebbles as in horizon above; very few, fine, whitish, soft calcium carbonate lumps in lower part; calcareous; moderately alkaline; gradual, wavy boundary.

Cca—48 to 72 inches, pale-brown (10YR 6/3) clay; brown (10YR 5/3) moist; massive; very hard, very firm, sticky and plastic; about 10 percent by volume of whitish soft lumps and weakly to strongly cemented concretions of calcium carbonate that decrease in amount with increasing depth; very few siliceous pebbles as in horizon above; calcareous; moderately alkaline.

The solum ranges from 40 to 66 inches in thickness. Content of clay ranges from 40 to 60 percent. When these soils

are dry, cracks 1 to 3 inches wide extend to a depth of 20 to 40 inches or more.

The A horizon is gray or dark gray. The AC horizon is light brownish gray or grayish brown.

Structure is weak to strong, fine to coarse, angular blocky. Many peds are wedge shaped and have an axis tilted more than 10 degrees from horizontal. Slickensides occur below a depth of 24 inches.

The content of calcium carbonate in the Cca horizon ranges from a few powdery masses and weakly cemented concretions to 40 percent by volume.

Lipan clay (Lc).—This soil generally is in somewhat rounded areas 5 to 40 acres in size. It is also in few areas of shallow drainageways that are more than 3 miles long and are several hundred acres in size. Slopes are concave and are 0 to 1 percent.

Included with this soil in mapping are areas of similar but darker colored Tobosa soils. These soils make up about 5 percent of the total area of this mapping unit.

More than 90 percent of the acreage of this soil is cultivated. Cotton and grain sorghum are the main crops, but there are a few areas planted to wheat, oats, and barley.

The main concerns of management are controlling excess water and keeping the surface layer in good tilth. Some areas of this soil can be drained by drilling wells or shafts into underground cavities. Concentrating excess water in pits is feasible in some of these areas. Leaving crop residue on or near the surface helps to maintain tilth. Tilling the soil when it is not too wet also helps to maintain good tilth. If this soil is irrigated, a system that controls loss of soil and water is needed. Dryland capability unit IIIw-1 and irrigated capability unit IIs-1; Lakebed range site.

Mereta Series

The Mereta series consists of nearly level to gently sloping soils on outwash plains.

In a representative profile the surface layer is clay loam about 18 inches thick. It is dark brown in the upper 6 inches, dark grayish brown in the middle 6 inches, and brown in the lower 6 inches. The underlying material extends to a depth of 87 inches or more. The upper 3 inches is pinkish-white indurated caliche, the next 57 inches is pink silty clay loam, and the lower 9 inches is light reddish-brown clay loam.

Mereta soils are well drained and have slow surface runoff. Permeability is slow to very slow in the indurated caliche. Available water capacity is low.

These soils are suited to crops or to use as range or wildlife habitat.

Representative profile of Mereta clay loam, 0 to 1 percent slopes, 17.0 miles east of the courthouse in San Angelo along Farm Road 380, 6.9 miles north along Farm Road 1692, 3.2 miles east along Farm Road 1929, then 100 feet south in a field:

Ap—0 to 6 inches, dark-brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; weak, medium, subangular blocky structure; hard, firm; few caliche fragments and few rounded quartzitic pebbles 1/16 to 1/4 inch in diameter; calcareous; moderately alkaline; abrupt, smooth boundary.

A11—6 to 12 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, subangular blocky structure and moderate, very fine, granular; very hard, firm; few caliche fragments, few rounded quartzitic pebbles 1/16 to 1/4 inch in diameter, few earthworm casts; calcareous; moderately alkaline; gradual, wavy boundary.

A12—12 to 18 inches, brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate, medium, subangular blocky structure and weak, fine, granular; very hard, firm; few earthworm casts, few caliche fragments, few rounded quartzitic pebbles 1/16 to 1/4 inch in diameter; calcareous moderately alkaline; abrupt, wavy boundary.

Ccam—18 to 21 inches, pinkish-white (7.5YR 8/2) indurated caliche; few roots and a small amount of soil in cracks and between plates, 2 percent is soil like that in horizon above; calcareous; moderately alkaline; abrupt, wavy boundary.

Cca—21 to 78 inches, pink (7.5YR 8/4) silty clay loam, pink (7.5YR 7/4) moist; massive; hard, firm; few fine roots, few earthworm casts, and few slightly darker pockets of soil like that of A12 horizon; calcareous; moderately alkaline; diffuse, smooth boundary.

C—78 to 87 inches, light reddish-brown (5YR 6/4) clay loam, reddish brown (5YR 5/4) moist; massive; black stains on smooth surfaces.

The solum ranges from 14 to 20 inches in thickness and from dark grayish brown and dark brown to brown in color. Content of clay is 35 to 45 percent, and the content of caliche fragments less than 1 inch in diameter ranges from a few to 10 percent, by volume.

The induration in the Ccam horizon ranges from a thin laminar top on caliche plates to indurated masses of caliche 12 inches thick. The Ccam horizon in most places consists of a series of plates that have a thin seam of soil between the upper plates. The plates are 1/2 inch to 5 inches thick and 3 to 15 inches across. They are typically smooth on top and rough or nodular on the bottom.

Mereta clay loam, 0 to 1 percent slopes (MeA).—This soil is on outwash plains. It commonly is on the higher parts of the landscape, but in places it is at lower elevations than Kimbrough soils. Mapped areas are irregularly shaped and range from a few acres to 150 acres in size.

This soil has the profile described as representative of the series (fig. 6).

Figure 6.—**Profile of a Mereta clay loam that has indurated caliche at a depth of 15 inches.**

Included with this soil in mapping are areas of Kimbrough soils. These included soils makes up about 10 percent of the total area of this mapping unit. Also included are areas of Angelo soils, which make up about 5 percent.

This soil is used equally for crops and for range. Cotton, grain sorghum, small grain, and forage are the main crops.

The hazards of soil blowing and water erosion are slight. Available water capacity is low. Leaving crop residue on the surface helps to maintain tilth. If this soil is irrigated, a system that controls loss of soil and water is needed. Dryland capability unit IIIs-3 and irrigated capability unit IIIs-1; Shallow range site.

Mereta clay loam, 1 to 3 percent slopes (MeB).—This soil is on outwash plains. It commonly is on the higher parts of the landscape, but in places it is at lower elevations than Kimbrough soils. Mapped areas are irregularly shaped and range from a few acres to 150 acres in size.

The surface layer of this soil is dark grayish-brown clay loam about 15 inches thick. The next layer is indurated caliche about 4 inches thick. The underlying material is pink silty clay loam caliche that extends to a depth of 60 inches.

Included with this soil in mapping are areas of Kimbrough soils, Angelo soils, and Tulia soils. Kimbrough soils make up about 5 percent of the total area of this mapping unit, Angelo soils make up 2 percent, and Tulia soils make up 3 percent.

About one-half the area of this soil is used for crops, and the other one-half is used as range.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate. The main concerns in management are controlling water erosion and maintaining tilth. Terraces and contour farming help to control water erosion, and leaving crop residue on the surface helps to maintain good tilth. Diversion terraces and grassed waterways are needed in places to control runoff from other soils. If this soil is irrigated, a system that controls loss of soil and water is needed. Dryland capability unit IIIe-4 and irrigated capability unit IIIe-2; Shallow range site.

Mereta-Urban land complex, 0 to 3 percent slopes (MuB).—This complex consists of 55 percent Mereta clay loam, 40 percent Urban land, and 5 percent included soils. The percentage of Urban land in mapped areas ranges from 25 to 58 percent. The areas of Mereta soils and Urban land are so intermingled or so small in size that they cannot be shown separately at the scale mapped.

The surface layer of the Mereta soil is about 16 inches thick. The next layer is indurated caliche about 4 inches thick. The underlying material is pink silty clay loam caliche that extends to a depth of 60 inches. A few areas of this soil have been altered by the addition of 1 to 2 inches of imported topsoil.

Urban land is made up of streets, single-unit dwellings, driveways, sidewalks, business buildings, schools, churches, and parking lots. Before urban development, these areas were dominantly Mereta soils. The soils in these areas have been so altered by urban works, construction, and earthmoving that identification is not practical.

Corrosivity of the Mereta soil to uncoated steel is high. The shrink-swell potential is moderate and is a problem in maintaining building foundations, streets, and other works of concrete and asphalt.

The Mereta soil is suited to most of the common landscaping plants used in the county. For best plant growth, the depth of cuts made during land leveling should be limited to less than 4 inches. The indurated caliche layer should be removed before planting trees. Not placed in a capability unit or range site.

Olton Series

The Olton series consists of nearly level to gently sloping soils on outwash plains.

In a representative profile the surface layer is brown clay loam about 10 inches thick. The next layer extends to a depth of 80 inches. The upper 4 inches is dark-brown clay, the next 18 inches is reddish-brown clay, the next 28 inches is pink silty clay loam, and the lower 20 inches is pink clay loam.

Olton soils are well drained and have slow surface runoff. Permeability is moderately slow. Available water capacity is high.

These soils are well suited to many kinds of crops. Areas used as range or wildlife habitat have many kinds of forage plants.

Representative profile of Olton clay loam, 0 to 1 percent slopes, 11.0 miles northeast of the courthouse in San Angelo along U.S. Highway 67, 3.6 miles north along Farm Road 1692, 0.6 mile west along a county road, then 150 feet north in a field:

Ap—0 to 10 inches, brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak, very fine and fine, subangular blocky structure; hard, firm; 1 to 10 percent of the surface covered by small, hard pebbles; noncalcareous; moderately alkaline; clear, smooth boundary.

B21t—10 to 14 inches, dark-brown (7.5YR 3/2) clay, dark reddish brown (5YR 3/3) moist; weak, very fine and medium, subangular blocky structure; hard, firm; few earthworm casts; few, small, hard pebbles; noncalcareous; moderately alkaline; gradual, wavy boundary.

B22t—14 to 24 inches, reddish-brown (5YR 4/3) clay, dark reddish brown (5YR 3/4) moist; moderate, medium, blocky structure; very hard, firm; few thin clay films on peds; few earthworm casts; few, small, hard pebbles; calcareous; moderately alkaline; gradual, wavy boundary.

B23t—24 to 32 inches, reddish-brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate, medium, blocky structure; very hard, firm; few thin clay films; calcareous; moderately alkaline; clear, wavy boundary.

B24tca—32 to 60 inches, pink (7.5YR 8/4) silty clay loam, pink (7.5YR 7/4) moist; weak, fine, blocky structure; very hard, firm; about 50 percent calcium carbonate, of which 10 to 20 percent is concretions ¼ to 1 inch in diameter; calcareous; moderately alkaline; clear, wavy boundary.

B25t—60 to 80 inches, pink (5YR 7/4) clay loam, yellowish red (5YR 5/6) moist; very hard, firm; calcareous; moderately alkaline.

The solum ranges from 60 inches to more than 80 inches in thickness. The dark-colored layer ranges from 11 to 20 inches in thickness and includes all of the A horizon and

the upper part of the B horizon. Depth to secondary carbonates is 24 inches or less.

The A horizon ranges from 8 to 14 inches in thickness and from dark brown, brown, or dark reddish gray to dark reddish brown in color. Reaction ranges from neutral to moderately alkaline.

The Bt horizon is clay loam or clay. Clay content is 35 to 45 percent. The horizon ranges from reddish brown or brown to dark brown in color. Structure ranges from fine to medium, subangular blocky to moderate blocky. Reaction is mildly alkaline to moderately alkaline.

Depth to a distinct zone of calcium carbonate accumulation ranges from 30 to 60 inches. This layer ranges from clay loam to silty clay loam in texture. The content of calcium carbonate ranges from 20 to 60 percent, of which 10 to 50 percent is concretions.

Olton clay loam, 0 to 1 percent slopes (OlA).—This soil is on outwash plains. It is plane to slightly concave. This soil has the profile described as representative of the series (fig. 7).

Included with this soil in mapping are areas of similar soils that have a layer in the subsoil that is 30 to 35 percent clay. This included soil makes up 5 percent of the total area of this mapping unit. Also included are areas of Angelo soils, which make up about 15 percent, and Rotan soils, which make up about 10 percent. Soils that have an indurated zone of calcium carbonate make up about 1 percent.

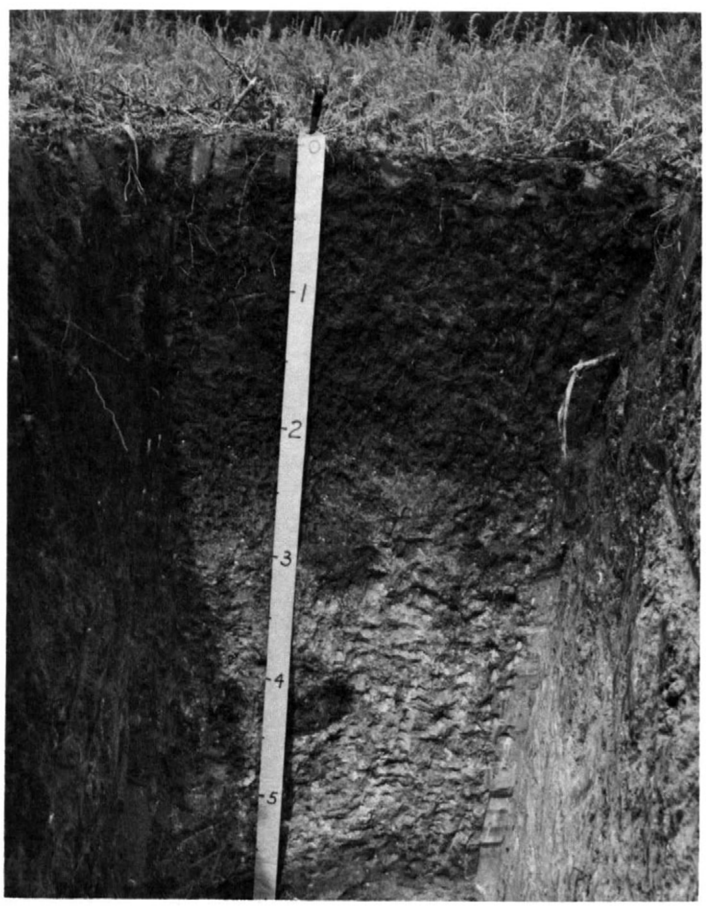

***Figure 7.*—Profile of an Olton clay loam. This soil is noncalcareous in the upper part and strongly calcareous in the lower.**

About one-half the area of this soil is used for crops, and one-half is used as range. Cotton, grain sorghum, and small grain are the main crops.

The hazards of soil blowing and water erosion are slight. The main concern in management is maintenance of tilth. Management of crop residue helps to maintain tilth. If this soil is irrigated, a system that controls loss of soil and water is needed. Dryland capability unit IIIe–3 and irrigated capability unit I–1; Clay Loam range site.

Olton clay loam, 1 to 3 percent slopes (OlB).—This soil is near Olton clay loam, 0 to 1 percent slopes.

The surface layer of this soil is dark-brown clay loam about 8 inches thick. The next layer extends to a depth of 60 inches or more. The upper 23 inches is brown clay, and the rest is pink silty clay loam.

Included with this soil in mapping are about equal parts of Angelo, Slaughter, and Rotan soils. These soils make up about 25 percent of the total area of the mapping unit.

This soil is well suited to crops but is used mostly for range. Cotton, grain sorghum, and small grain are the main crops.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate. The main concerns of management are controlling water erosion and maintaining good tilth. Terraces and contour farming help to control water erosion, and leaving crop residue on the surface helps to maintain good tilth. Diversion terraces and grassed waterways are needed in places to control runoff from other soils. If this soil is irrigated, a system that controls loss of water is needed. Dryland capability unit IIIe–1 and irrigated capability unit IIe–1; Clay Loam range site.

Olton-Urban land complex, 0 to 3 percent slopes (OuB).—This complex consists of about 60 percent Olton soils and 40 percent Urban land. The percentage of Urban land in mapped areas ranges from 30 to 50 percent. Areas of Olton soils and Urban land are so intermingled or so small in size that they cannot be shown separately at the scale mapped.

The surface layer of the Olton soils is brown clay loam about 12 inches thick. The next layer extends to a depth of 60 inches or more. The upper 20 inches is dark-brown clay, and the rest is pink silty clay loam. A few areas of these soils have been altered by the addition of 1 to 2 inches of imported topsoil.

Urban land is made up of streets, single-unit dwellings, driveways, sidewalks, business buildings, schools, churches, and parking lots. Before urban development, these areas were dominantly Olton soils. The soils in these areas have been so altered by urban works, construction, and earthmoving that identification is not practical.

The corrosivity of the Olton soils to uncoated steel is moderate. The shrink-swell potential is moderate and is a problem in maintaining building foundations, streets, and other works of concrete or asphalt.

The Olton soils are well suited to the common landscaping plants used in the county. They can be used for such plants as roses, pyracantha, and peaches without the occurrence of iron chlorosis. The addition

of large amounts of calcareous soil material makes iron less available to these plants. Not placed in a capability unit or range site.

Owens Series

The Owens series consists of gently sloping to sloping soils on hillsides. These soils formed in marine clays.

In a representative profile the surface layer is reddish-brown clay about 6 inches thick. The next layer is reddish-brown clay about 10 inches thick. The underlying material is dense, angular shaly clay.

Owens soils are well drained and have rapid surface runoff. Permeability is very slow. Available water capacity is low.

These soils are better suited to use as range and wildlife habitat than to most other uses.

Owens soils are mapped only in a complex with Kimbrough soils in Tom Green County.

Representative profile of an Owens clay in an area of Kimbrough-Owens complex, 1 to 8 percent slopes, 6.2 miles southwest of the courthouse in San Angelo along U.S. Highway 67, then 0.3 mile south, at a point 100 yards south of the railroad:

A1—0 to 6 inches, reddish-brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; weak, very fine, subangular blocky structure and weak, fine, granular; very hard, very firm; common roots; few limestone and chert fragments ¼ to 1 inch in diameter; calcareous; moderately alkaline; gradual, wavy boundary.

B2ca—6 to 16 inches, reddish-brown (2.5YR 5/4) clay, dark red (2.5YR 3/6) moist; weak, very fine and fine, subangular blocky structure and moderate, very fine and fine, blocky; very hard, very firm; few roots; this is a little more compact than horizon above; contains 3 percent soft calcium carbonate aggregates and 5 percent rounded pebbles ⅛ to ½ inch in diameter; calcareous; moderately alkaline; gradual, wavy boundary.

C—16 to 72 inches, reddish-brown (2.5YR 5/4) shaly clay, reddish brown (2.5YR 4/4) moist; massive, angular rock structure; very hard, very firm; contains bluish lenses of clay; calcareous; moderately alkaline.

The solum ranges from 12 to 20 inches in thickness. The A horizon ranges from 4 to 7 inches in thickness. It is reddish brown or weak red. The B horizon has a dry color of reddish brown or weak red. Reaction is moderately alkaline throughout the profile. The A and B horizons are calcareous. In some profiles the C horizon is noncalcareous. The texture throughout the profile is clay, gravelly clay, or silty clay.

Rioconcho Series

The Rioconcho series consists of nearly level to gently sloping soils that formed in alluvium on flood plains.

In a representative profile the surface layer is dark grayish-brown clay loam about 36 inches thick. The underlying material is light-brown clay loam that extends to a depth of 80 inches.

These soils are subject to flooding once in 3 to 20 years. Floods seldom last for more than 1 day.

Rioconcho soils are moderately well drained and have slow surface runoff. Permeability is slow. Available water capacity is high.

These soils are suitable for crops, pecan orchards, range, and wildlife habitat.

Representative profile of a Rioconcho clay loam in an area of Rioconcho and Spur soils, 10.0 miles northeast of the courthouse in San Angelo along U.S. Highway 87, 1.5 miles south along Ranch Road 2288, then 0.1 mile east in an area of rangeland:

A11—0 to 14 inches, dark grayish-brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; weak, fine, granular structure and moderate, very fine, subangular blocky; hard, firm, but crushes easily into granules; many roots, few fine pores, few worm casts; calcareous; moderately alkaline; gradual, wavy boundary.

A12—14 to 36 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, fine and medium, subangular blocky structure; very hard, firm, but crushes easily into granules, sticky; few roots, few fine pores, few worm casts; calcareous; moderately alkaline; diffuse, wavy boundary.

C—36 to 80 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; weak, fine, subangular blocky structure; very hard, friable, sticky; few roots; few films and threads of calcium carbonate above a depth of 70 inches; calcareous; moderately alkaline.

The solum ranges from 20 to 50 inches in thickness. Depth to gravel, sand, or limestone ranges from 6 to 20 feet. The A horizon is more than 35 percent clay. It is very dark grayish brown, dark grayish brown, or dark brown. In places it has strata that are 5 to 20 percent gravel.

The C horizon is clay loam, silty clay loam, or silty clay that is 35 to 50 percent clay. It is brown, grayish brown, or light brown. About 5 percent of the area of these soils has strata that are 5 to 35 percent gravel.

Rioconcho clay loam (Rn).—This soil is in channels and on narrow flood plains of creeks and their tributaries. Slopes are 0 to 2 percent. In areas adjacent to the stream channels, this soil is steeper and the slopes are concave. The steep streambanks are very narrow and comprise 1 percent of the total area of this mapping unit. The flood plains are only 2 to 10 feet higher than the stream channels.

The surface layer of this soil is dark grayish-brown clay loam about 40 inches thick. The underlying material is light-brown clay loam that extends to a depth of 60 inches.

Included with this soil in mapping are areas of soils that are more clayey and areas of soils that have an eroded surface layer. These soils make up about 30 percent of the total area of this mapping unit.

This soil is used equally for crops and for range. Cotton, grain sorghum, and small grain are the main crops. This soil is well suited to trees.

The hazards of soil blowing and water erosion are slight. The main concerns in management are maintaining good tilth and controlling flooding. Flooding generally occurs on at least part of the flood plain once in each year. Flooding occurs several times during some years, and crops are damaged. Leaving crop residue on the surface helps to maintain good tilth. The crop least damaged by flooding is grain sorghum. If this soil is irrigated, a system that controls loss of soil and water is needed. Dryland capability unit IIc-1 and irrigated capability unit I-3; Bottom Land range site.

Rioconcho and Spur soils (Rs).—These soils are on flood plains of major streams. Slopes are nearly level and plane or slightly undulating. Steeper areas of these soils are along old channels that are now filled or are near the present channel. Some lower lying areas have been slightly eroded by floodwaters or have received sediment deposited by them.

This undifferentiated group is about 62 percent Rioconcho clay loam, 25 percent Spur clay loam, and 13 percent included soils.

The Rioconcho and Spur soils have the profile described as representative for their respective series.

The Rioconcho soils typically are at the lower elevations in the mapping unit, but they are not next to the stream channels in all places. The Spur soils commonly are adjacent to the stream channels and are in areas a few inches to a few feet higher than the more distant Rioconcho soils. These soils are not uniform, and they occur without regularity. Some areas are Rioconcho soils, and other areas are Rioconcho and Spur soils.

Included with these soils in mapping are areas of soils that formed in more recently deposited material. These soils are near the stream channels and are lighter colored and more stratified than the Rioconcho and Spur soils. These included soils make up about 5 percent of the total area of this mapping unit.

Most of the acreage of these soils is in crops, and some of this acreage is irrigated. Cotton, grain sorghum, and small grain are the main crops.

Flooding occurs on these soils once in 3 to 20 years and seldom lasts for more than 1 day. The hazards of soil blowing and water erosion are slight. The main concern in management is maintenance of tilth. Leaving crop residue on the surface helps to maintain good tilth. If this soil is irrigated, a system that controls loss of soil and water is needed. Dryland capability unit IIc-1 and irrigated capability unit I-3; Bottom Land range site.

Rotan Series

The Rotan series consists of nearly level soils on outwash plains.

In a representative profile the surface layer is very dark grayish-brown, noncalcareous clay loam about 8 inches thick. The next layer extends to a depth of 96 inches. The upper 30 inches is brown and dark-brown clay, the next 46 inches is pink clay loam, and the lower 12 inches is brown clay loam. The underlying material is pink clay loam that extends to a depth of 108 inches.

Rotan soils are well drained and have very slow to slow surface runoff. Permeability is moderately slow. Available water capacity is high.

These soils are suited to many kinds of crops. They are also well suited to use as range and wildlife habitat.

Representative profile of Rotan clay loam, 0 to 1 percent slopes, 11.0 miles east of the courthouse in San Angelo along Farm Road 380, 1.25 miles north on an unnumbered paved road, 2.0 miles north on a county road, then 200 feet east in a pasture:

A11—0 to 2 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak, subangular blocky structure; slightly hard, firm; thin platy crust on the surface; noncalcareous; moderately alkaline; abrupt, smooth boundary.

A12—2 to 8 inches, very dark grayish-brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; moderate, fine, granular structure and moderate, fine and very fine, subangular blocky; hard, firm; noncalcareous; moderately alkaline, abrupt, wavy boundary.

B1t—8 to 12 inches, dark-brown (10YR 3/3) clay, very dark brown (10YR 2/2) moist; moderate, fine, granular structure and very fine to medium, subangular blocky; very hard, firm; noncalcareous; moderately alkaline; abrupt, wavy boundary.

B21t—12 to 22 inches, dark-brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate, medium, blocky structure; very hard, firm; thin clay films on peds; calcareous; moderately alkaline; clear, wavy boundary.

B22t—22 to 34 inches, brown (7.5YR 5/2) clay, dark brown (7.5YR 4/2) moist; moderate, medium, blocky structure; very hard, firm; few roots; few calcium carbonate concretions 1/16 to 1/4 inch in diameter, few dark grayish-brown mottles formed from soil from the A horizon falling into cracks; calcareous; moderately alkaline; diffuse, wavy boundary.

B23tca—34 to 38 inches, brown (7.5YR 5/4) clay, dark brown (7.5YR 4/2) moist; moderate, medium, blocky structure; very hard, firm; few roots; 5 to 10 percent soft calcium carbonate concretions 1/16 to 1/4 inch in diameter; calcareous; moderately alkaline; clear, wavy boundary.

B24tca—38 to 58 inches, pink (7.5YR 8/4) clay loam; light brown (7.5YR 6/4) moist; moderate, medium, subangular blocky structure; hard, firm; contains 15 percent soft calcium carbonate concretions as large as 1/2 inch in diameter; calcareous; moderately alkaline; diffuse, wavy boundary.

B25tca—58 to 84 inches, pink (7.5YR 7/4) and strong-brown (7.5YR 5/6) clay loam, brown (7.5YR 5/4) moist; weak, medium, blocky structure; hard, firm; less calcium carbonate than in horizon above, but more than 15 percent; calcareous; moderately alkaline; diffuse, wavy boundary.

B26tca—84 to 96 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; weak, medium, blocky structure; hard, firm; few soft calcium carbonate aggregates; calcareous; moderately alkaline; clear, wavy boundary.

C—96 to 108 inches, pink (7.5YR 7/4) clay loam, brown (7.5YR 5/4) moist; massive; hard, firm; no apparent weathering; cubical rock structure that has a dendritic pattern of black stains on the surface.

The solum ranges from 60 inches to more than 100 inches in thickness. Secondary carbonates begin at a depth of 12 to 24 inches, and depth to the horizon of lime accumulation ranges from 30 to 57 inches.

The A horizon ranges from 7 to 12 inches in thickness. In places the upper 1 or 2 inches is silty clay loam and has platy structure. It is dark grayish brown, dark brown, or very dark grayish brown.

The Bt horizon above the horizon of lime accumulation is dark-brown, dark grayish-brown, brown, and reddish-brown clay, clay loam, or silty clay loam. It generally has moderate, fine to medium, blocky structure, but in the upper 4 to 6 inches of some profiles it has very fine to medium, subangular blocky structure. The Btca horizon has 5 to 50 percent visible secondary carbonates that have few to common concretions. It is brown, pink, light brown, strong brown, or yellowish red.

The C horizon is pink, light brown, or yellowish red.

Rotan clay loam, 0 to 1 percent slopes (RtA).—This deep soil is on high terraces or in slightly depressional rounded areas (fig. 8).

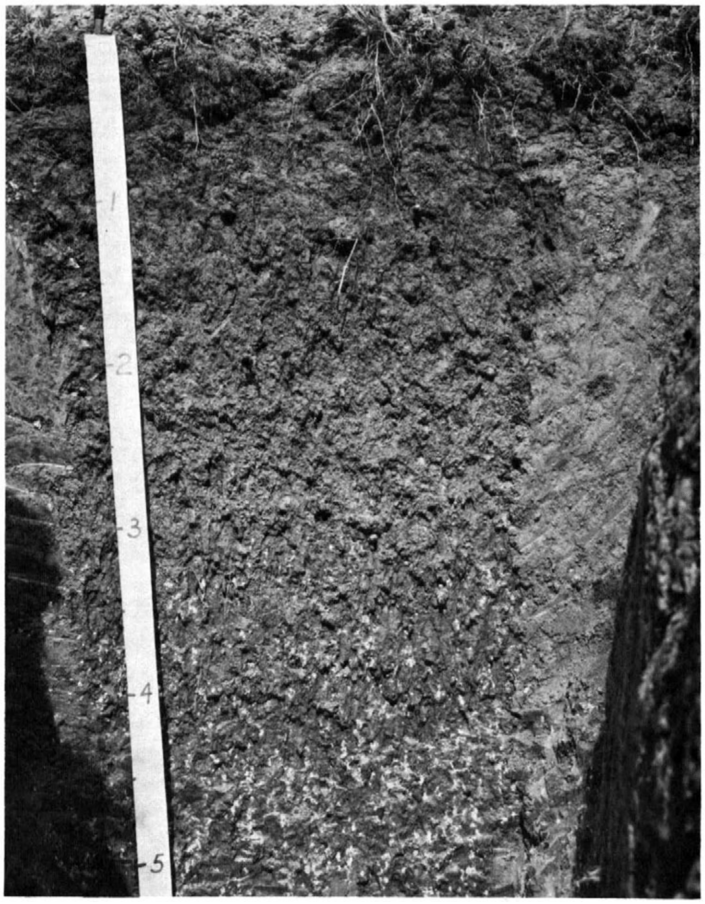

Figure 8.—**Profile of a Rotan clay loam that has calcium carbonate concretions. These concretions are common below a depth of 34 inches.**

Included with this soil in mapping are areas of a similar soil that has a clay surface layer, and small areas of Olton and Angelo soils. The areas of these soils are less than 5 acres in size and make up less than 10 percent of the total area of this mapping unit.

This soil is suitable for crops, but some areas are used for range. Cotton, grain sorghum, and small grain are the major crops.

The hazards of soil blowing and water erosion are slight. If this soil is cropped, the main concern in management is maintenance of good tilth. Leaving crop residue on the surface helps to maintain good tilth. If this soil is irrigated, a system that controls loss of soil and water is needed. Dryland capability unit IIc-2 and irrigated capability unit I-1; Clay Loam range site.

Slaughter Series

The Slaughter series consists of nearly level to gently sloping soils on outwash plains.

In a representative profile the surface layer is dark-brown clay loam about 6 inches thick. The next layer is clay about 10 inches thick. The upper 6 inches is dark brown, and the lower 4 inches is reddish brown. The underlying material is caliche that extends to a depth of 80 inches (fig. 9).

Slaughter soils are well drained and have slow surface runoff. Permeability is moderately slow. Available water capacity is low.

These soils are suited to many kinds of crops and to use as range and wildlife habitat.

Representative profile of a Slaughter clay loam in an area of Slaughter-Kimbrough complex, 0 to 1 percent slopes, 3.4 miles north of the courthouse in San Angelo, 20 feet east of U.S. Highway 87, then 150 feet north of the intersection of North Chadbourne and 44th Streets:

A1—0 to 6 inches, dark-brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak, fine, subangular blocky structure and moderate, fine, granular; hard, firm; noncalcareous; moderately alkaline; clear, wavy boundary.

B21t—6 to 12 inches, dark-brown (7.5YR 3/2) clay, dark brown (7.5YR 3/2) moist; moderate, medium, granular structure and moderate, medium, subangular blocky; very hard, firm; few earthworm casts; noncalcareous; moderately alkaline; gradual, wavy boundary.

B22t—12 to 16 inches, reddish-brown (5YR 4/3) clay; dark reddish brown (5YR 3/3) moist; weak to moderate, fine and medium, blocky structure; very hard,

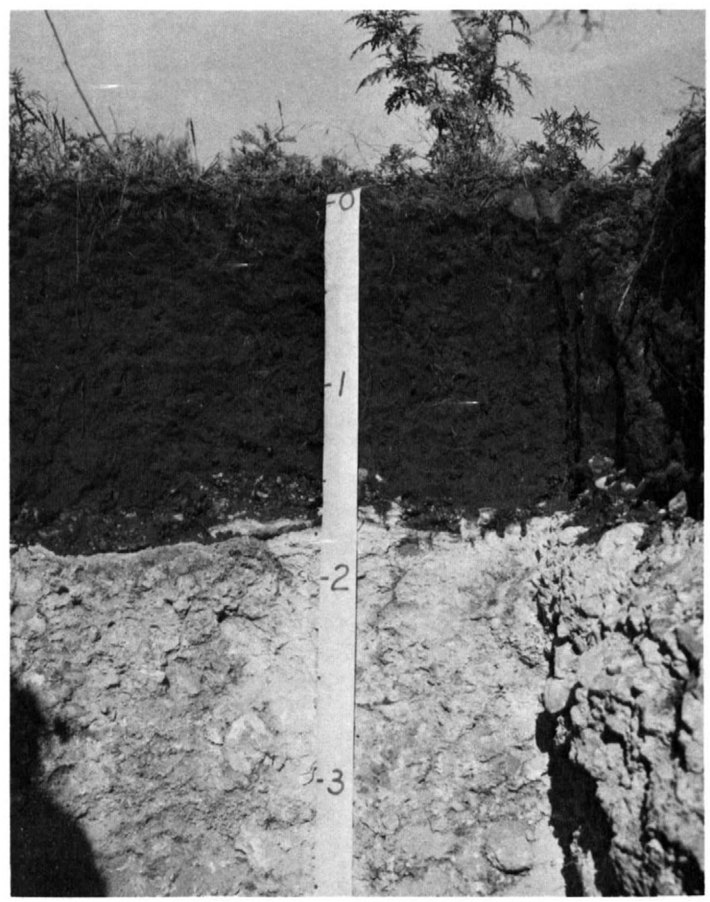

Figure 9.—**Profile of a Slaughter clay loam. This soil is noncalcareous and has indurated caliche at a depth of 10 to 20 inches.**

firm; clay films on all ped surfaces; noncalcareous; moderately alkaline; abrupt, wavy boundary.

Ccam—16 to 34 inches, pink (7.5YR 8/4) indurated caliche, pink (7.5YR 7/4) moist; smooth and laminar on the upper surface; calcareous; moderately alkaline; clear, wavy boundary.

C—34 to 80 inches, slightly whiter nodular caliche.

The solum ranges from 10 to 20 inches in thickness over an indurated caliche layer. The A horizon ranges from 4 to 8 inches in thickness. It is dark brown, brown, or reddish brown. The Bt horizon is clay loam or clay that is 35 to 45 percent clay. It ranges from 6 to 12 inches in thickness. It is reddish brown and dark brown to dark reddish brown. The Ccam horizon is 6 to 24 inches in thickness.

Slaughter clay loam, 1 to 3 percent slopes (ShB).—This soil is in scattered areas on the landscape.

The surface layer of this soil is brown clay loam about 5 inches thick. The next layer is reddish-brown clay about 10 inches thick. The next lower layer is about 12 inches of indurated caliche. Sandy clay loam overwash from higher lying sandy soils is present in some places, and this overwash is 1 to 4 inches thick. A few areas have gullies about 1 foot deep and at intervals of 100 to 250 feet.

Included with this soil in mapping are areas of Kimbrough soils that make up about 10 percent of the total area of this mapping unit. Also included are areas of Mereta soils that make up about 5 percent.

About 80 percent of the acreage of this soil is in range, and 20 percent is in crops. Cotton, grain sorghum, and small grain are the main crops.

The hazard of water erosion is moderate. Terraces and contour farming help to control water erosion and runoff. Diversion terraces and grassed waterways are needed in places to control runoff from other soils. If this soil is irrigated, a system that controls loss of soil and water is needed. Dryland capability unit IVe–1 and irrigated capability unit IIIe–2; Shallow range site.

Slaughter-Kimbrough complex, 0 to 1 percent slopes (SkA).—This complex is about 44 percent Slaughter soils, 25 percent Kimbrough soils, 20 percent a soil that is similar to Slaughter soils but is less clayey, and 11 percent Mereta and Olton soils. The areas of Slaughter and Kimbrough soils are so intermingled or so small in size that they cannot be shown separately at the scale mapped.

Kimbrough gravelly loams typically are in the higher, slightly convex areas, but Mereta clay loams are in some of these areas. The Slaughter soils typically are in slightly concave areas about 1 to 5 inches lower than the adjoining Kimbrough or Mereta soils. The areas of the soils in this complex are 15 feet to about 600 feet wide. Most areas are irregularly shaped, but the areas of Olton soils are rounded. Runoff from areas of this complex is to intermittent lakes and streams.

Slaughter soils have the profile described as representative of the series.

Kimbrough soils have a surface layer of dark-brown gravelly loam about 14 inches thick over indurated caliche.

These soils are used mostly for crops and range. The hazards of soil blowing and water erosion are slight. The main concern in management is maintaining tilth. Leaving crop residue on the surface helps to maintain good tilth. If this soil is irrigated, a system that meets plant needs and controls loss of soil and water is needed. Both soils are in dryland capability unit IVe–1; Slaughter soils are in the Shallow range site, and Kimbrough soils are in the Very Shallow range site.

Slaughter-Urban land complex, 0 to 1 percent slopes (SuA).—This complex is about 30 percent Slaughter soils and about 30 percent Urban land. The remaining 40 percent consists of other soils, including Kimbrough and Mereta soils. The percentage of Urban land in mapped areas ranges from 20 to 35 percent. The areas of Slaughter soils and Urban land are so intermingled or so small in size that they cannot be shown separately at the scale mapped.

The surface layer of the Slaughter soils is brown clay loam about 8 inches thick. The next layer is dark-brown clay about 4 inches thick. The next lower layer is reddish-brown clay about 6 inches thick. This layer is underlain by indurated pink caliche. A few areas of these soils have been altered by the addition of 1 to 3 inches of imported topsoil.

Urban land is made up of streets, single-unit dwellings, driveways, sidewalks, business buildings, schools, churches, and parking lots. Before urban development these areas were dominantly Slaughter soils. The soils in these areas have been so altered by urban works, construction, and earthmoving that identification is not practical.

Problems encountered in urbanization are mostly caused by the indurated caliche layer in these soils. This layer is difficult to excavate. It is at a depth of 10 to 20 inches in Slaughter soils and at a depth of 4 to 12 inches in Kimbrough soils. Shrink-swell potential in Slaughter soils is moderate. Corrosivity of Slaughter and Kimbrough soils to uncoated steel is high.

These soils are suitable for most of the common landscaping plants used in the county. The depth of cuts made during land leveling should be shallow. Calcareous materials should not be spread on these soils. The indurated caliche layer should be removed before planting trees. Not placed in a capability unit or range site.

Spur Series

The Spur series consists of nearly level alluvial soils on flood plains.

In a representative profile the surface layer is dark grayish-brown clay loam about 14 inches thick. The next layer is light-brown clay loam about 30 inches thick. The underlying material is light-brown clay loam that extends to a depth of 80 inches.

Spur soils are well drained and have slow surface runoff. Permeability is moderate. Available water capacity is high. These soils are subject to flooding about once in 3 to 20 years, except in areas where they are protected by flood control dams.

These soils are suited to crops, range, and wildlife habitat.

Spur soils are mapped only in an undifferentiated group with the Rioconcho soils.

Representative profile of a Spur clay loam in an area of Rioconcho and Spur soils, 10.0 miles northwest of the courthouse in San Angelo along U.S. Highway 87, 1.2 miles south along Ranch Road 2288, then 200 feet east in an area of rangeland:

A1—0 to 14 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak, fine, subangular blocky structure and weak, fine, granular; hard, firm; few fine roots, upper 4 inches appears to be recent deposition by flooding; calcareous; moderately alkaline; gradual, wavy boundary.

B2—14 to 44 inches, light-brown (7.5YR 6/4) clay loam, dark brown (7.5YR 4/2) moist; weak, medium, subangular blocky structure; very hard, firm; few threads of calcium carbonate, common earthworm casts; calcareous; moderately alkaline; gradual, wavy boundary.

C—44 to 80 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 4/4) moist; weak, medium, subangular blocky structure; very hard, firm; calcareous; moderately alkaline.

The solum is more than 40 inches thick. The A horizon ranges from 10 to 17 inches in thickness. It ranges from clay loam to loam and is 25 to 35 percent clay. It is dark brown, grayish brown, and dark grayish brown. The B horizon is light brown to brown. It ranges from clay loam to loam and is 25 to 35 percent clay.

Tarrant Series

The Tarrant series consists of undulating to hilly soils underlain by limestone.

In a representative profile the surface layer is very dark grayish-brown cobbly clay that is about 25 to 70 percent limestone fragments. It is underlain at a depth of about 10 inches by hard limestone bedrock.

Tarrant soils are well drained and have rapid surface runoff. Permeability is moderate. Available water capacity is low.

These soils are better suited to use as range and wildlife habitat than to most other uses. They are not suited to crops. Most of the acreage of these soils is used as range.

Representative profile of a Tarrant cobbly clay in an area of Tarrant association, undulating, 0.8 mile east of the intersection of U.S. Highway 277 and Ranch Road 2084 in Christoval, and 100 feet south of Ranch Road 2084 in an area of rangeland:

A11—0 to 4 inches, very dark grayish-brown (10YR 3/2) cobbly clay, very dark brown (10YR 2/2) moist; weak, fine, subangular blocky structure and moderate, very fine, granular; slightly hard, firm; 25 percent of the horizon and 40 percent of the surface is limestone fragments ranging in size from ⅛ inch to 18 inches; some spots are about 50 percent worm casts; calcareous; moderately alkaline; clear, wavy boundary.

A12—4 to 10 inches, very dark grayish-brown (10YR 3/2) cobbly clay, very dark brown (10YR 2/2) moist; moderate, medium, subangular blocky structure and moderate, very fine and fine, granular; very hard, firm; few worm casts; 70 percent is limestone fragments ⅛ inch to 18 inches in size; calcareous; moderately alkaline, abrupt, wavy boundary.

R—10 to 12 inches, white, hard limestone that has soil in cracks.

Coarse fragments, most of which are more than 1 inch in diameter, cover 30 to 90 percent of the surface. The solum ranges from 6 to 15 inches in thickness. It is 35 to 75 precent coarse fragments. Coarse fragments make up 10 to 60 percent of the A11 horizon and 70 to 90 percent of the A12 horizon. Texture of the fines ranges from clay to silty clay, and the content of clay ranges from 45 to 50 percent. Colors are dark grayish brown, very dark grayish brown, grayish brown, brown, and dark brown.

Tarrant association, undulating (TaC).—These soils are on rounded, low hills and the less sloping tops of steeper hills. Slopes are 1 to 8 percent. Mapped areas are large and irregular. They are much larger and more variable in composition than are other mapped areas in the county. Mapping has been controlled well enough, however, for the anticipated use of the soils.

A Tarrant soil in this association has the profile described as representative of the series (fig. 10).

Included with these soils in mapping are areas of Ector and Kavett soils and rock outcrops. Also included are some shallow to deep colluvial soils in drainageways. Ector soils make up about 5 percent of the total area of this mapping unit; Kavett soils 2 percent; colluvial soils 5 percent; and rock outcrops 2 percent. The rock outcrops are about 6 feet across and generally are higher than other areas. About 10 percent of the outcrop area is vegetated, and most of the vegetation grows on soil material in cracks in the rock. The outcrops are the hardest strata in the horizontally bedded limestone.

All areas of these soils are in range, and the plant cover consists of many kinds of woody plants, forbs, and grasses. The hazard of soil blowing is slight, and the hazard of water erosion is moderate. Dryland capability unit VIIs–2; Low Stony Hill range site.

Tarrant association, hilly (TaE).—These soils are on the sides of the steeper limestone hills. Mapped areas are much larger and more variable in composition than are other mapped areas in the county. Mapping has been controlled well enough, however, for the anticipated use of the areas.

The surface layer of a Tarrant soil in this association is grayish-brown cobbly clay about 8 inches thick. It is underlain by hard limestone.

Included with these soils in mapping are areas of rock outcrops and Ector soils. Rock outcrops make up less than 10 percent of the total area of this mapping unit, and Ector soils make up about 5 percent.

All of the acreage of these soils is in range. The plant cover consists of many kinds of grasses, forbs, and woody plants that are good forage for both livestock and wildlife.

Light rains provide adequate water for some plant growth, because runoff is concentrated in the area around stones. The hazard of soil blowing is slight, and the hazard of water erosion is severe. Dryland capability unit VIIs–2; Low Stony Hill range site.

Tobosa Series

The Tobosa series consists of nearly level to gently sloping soils on outwash plains and in drainageways.

In a representative profile the surface layer is dark grayish-brown clay about 20 inches deep. The next layer is brown clay about 24 inches thick. The underlying material is pinkish-white silty clay that extends to a depth of 80 inches.

Figure 10.—**Area of Tarrant association, undulating. These soils are cobbly and stony clay about 10 inches deep over hard limestone.**

Tobosa soils are moderately well drained and have medium surface runoff. When these soils are dry, cracks open and the soils absorb water rapidly, but when these soils are wet, permeability is very slow. Available water capacity is high.

These soils are suited to crops and to use as range and wildlife habitat.

Representative profile of Tobosa clay, 0 to 1 percent slopes, 11.0 miles northeast of the courthouse in San Angelo along U.S. Highway 67, 6.2 miles north on Farm Road 1692, then 100 feet south of Farm Road 1692 in a cropped field:

Ap—0 to 10 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate, very fine and medium, subangular blocky structure; very hard, very firm, sticky and plastic; common roots, few quartzitic pebbles 1/16 to 1/2 inch in diameter; the lower 5 inches is a massive plowpan; calcareous; moderately alkaline; clear, smooth boundary.

A1—10 to 20 inches, dark grayish-brown (10YR 4/2) clay, dark brown (10YR 3/3) moist; moderate, medium, blocky structure and moderate, very fine, subangular blocky; extremely hard, very firm, sticky and plastic; few roots, few vertical streaks of darker soil; few quartzitic pebbles 1/16 to 1/2 inch in diameter; calcareous; moderately alkaline; diffuse, wavy boundary.

AC1—20 to 32 inches, brown (7.5YR 5/2) clay, dark brown (7.5YR 4/2) moist; moderate, medium, blocky structure in wedge-shaped peds; hard firm, sticky and plastic; 10 percent of darker soil from horizons above in closed cracks, few slickensides are more than 3 inches across; calcareous; moderately alkaline; gradual, wavy boundary.

AC2—32 to 44 inches, brown (7.5YR 5/2) clay, brown (7.5YR 4/2) moist; moderate, medium, blocky structure in wedge-shaped peds; hard, firm, sticky and plastic; few roots, mostly on the ped surfaces; 10 percent is darker soil in closed cracks; few slickensides; calcareous; moderately alkaline; clear, wavy boundary.

Cca—44 to 80 inches, pinkish-white (7.5YR 8/2) silty clay, light brown (7.5YR 6/4) moist; 1/3 is soft white masses of calcium carbonate, a few cracks filled with soil from horizons above extend to a depth of 60 inches; calcareous; moderately alkaline.

The solum ranges from 41 to 60 inches in thickness. Undisturbed areas have gilgai microrelief that consists mostly of small pits or depressions about 4 inches deep and 12 feet across. Content of clay is 45 to 60 percent, and the clay is dominantly montmorillonite.

The A horizon ranges from 12 to 32 inches in thickness and is dark grayish brown to brown. The AC horizon ranges from 12 to 30 inches in thickness and is dark grayish brown and pale brown to brown. Structure is moderate to strong, fine to coarse, blocky. Most peds are wedge shaped, and some have slickensides 3 to 12 inches wide or more.

The zone of calcium carbonate accumulation is 2 to 20 percent calcium carbonate. Some of this calcium carbonate is in the form of concretions.

Tobosa clay, 0 to 1 percent slopes (ToA).—This soil is typically in concave areas that are only a few inches

lower in elevation than the surrounding soils. It is in broad and flat drainageways or on outwash plains. Most of the runoff is to intermittent lakes. The floor of a few intermittent lakes is Tobosa clay.

This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of a similar soil that has a solum 30 to 40 inches thick and areas of Lipan and Angelo soils. The similar soil makes up 10 percent of the total area of this mapping unit, and Lipan and Angelo soils combined make up 5 percent.

This soil is well suited to crops, and most of it is farmed. Cotton and grain sorghum are the main crops.

The hazards of soil blowing and water erosion are slight. The main concern in management is maintenance of good tilth. Leaving crop residue on the surface helps to maintain good tilth. Level terraces can be used for water conservation. If this soil is irrigated, a system that controls loss of soil and water is needed. Dryland capability unit IIIs–2 and irrigated capability unit IIs–1; Heavy Clay range site.

Tobosa clay, 1 to 3 percent slopes (ToB).—This soil has a surface layer of brown clay about 18 inches thick. The next layer is dark grayish-brown clay about 24 inches thick. The underlying material is pinkish-white silty clay that extends to a depth of 60 inches.

Included with this soil in mapping are areas of a similar soil that is 30 to 40 inches deep to the underlying material. This soil makes up 20 percent of the total area of this mapping unit. Also included are areas of Angelo soils that make up 7 percent.

This soil is suited to crops. Grain sorghum and cotton are the main crops.

The hazard of water erosion is moderate, and the hazard of soil blowing is slight. The main concerns of management are controlling water erosion and maintaining good tilth. Terraces and contour farming help to control water erosion, and leaving crop residue on the surface helps to maintain good tilth. Diversion terraces and grassed waterways are needed in places to control runoff from other soils. If this soil is irrigated, a system that controls loss of soil and water is needed. Dryland capability unit IIIe–1 and irrigated capability unit IIe–1; Heavy Clay range site.

Tulia Series

The Tulia series consists of nearly level to gently sloping soils on outwash plains.

In a representative profile the surface layer is grayish-brown loam about 10 inches thick. The next layer extends to a depth of 80 inches. The upper 15 inches is pinkish-gray loam, and the lower 65 inches is light-brown and pink silty clay loam.

Tulia soils are well drained and have medium surface runoff. Permeability is moderate. Available water capacity is high.

Tulia soils are suitable for crops, range, and wildlife habitat.

Representative profile of Tulia loam, 1 to 3 percent slopes, 18.0 miles east of the courthouse in San Angelo along Farm Road 380, 2.0 miles south on Farm Road 1692, 1.0 mile east on a county road, 0.1 mile south on another county road, then 100 feet west in an area of rangeland:

Ap—0 to 4 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak, fine, subangular blocky structure; hard, firm; few angular quartzitic pebbles and few caliche fragments 1/16 to 1/2 inch in diameter; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—4 to 10 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak, subangular blocky structure and weak, very fine, granular; hard, firm; few rounded quartzitic pebbles and caliche fragments 1/16 to 1/2 inch in diameter; common worm casts; calcareous; moderately alkaline; clear, wavy boundary.

B21ca—10 to 25 inches, pinkish-gray (7.5YR 7/2) clay loam, brown (10YR 5/3) moist; weak, subangular blocky structure and weak, very fine, granular; hard, firm; few pebbles and few caliche fragments 1/16 to 1/2 inch in diameter; common worm casts; calcareous; moderately alkaline; clear, wavy boundary.

B22tca—25 to 48 inches, light-brown (7.5YR 6/4) silty clay loam, light brown (7.5YR 6/y4) moist; weak, subangular blocky structure; hard, firm; about 20 percent visible calcium carbonate, some of which is in the form of concretions 1/16 to 1/2 inch in diameter; calcareous; moderately alkaline; diffuse, wavy boundary.

B23tca—48 to 80 inches, pink (7.5YR 8/4) silty clay loam, pink (7.5YR 7/4) moist; moderate, medium, subangular blocky structure; hard, firm; in the upper part is about 10 percent visible calcium carbonate that diminishes with increasing depth; the lower part appears to be more compact and approaches rock structure; calcareous; moderately alkaline.

The solum ranges from 20 to 40 inches in thickness to a buried B horizon. The A horizon is 5 to 14 inches thick. It ranges from grayish brown to brown.

The B2 horizon is 20 to 80 inches thick. It is loam to silty clay loam that is 25 to 35 percent clay. It ranges from light brown to pinkish gray, pink, reddish brown, brown, and reddish yellow. The calcium carbonate equivalent of the B horizon ranges from 15 to 70 percent. In the upper part of the B horizon, the carbonates are spread throughout; and in the lower part, some is in the form of soft aggregates and some is in the form of concretions. These visible aggregates are less than 1/2 inch in diameter.

Tulia loam, 0 to 1 percent slope (TuA).—This soil is in areas that range from about 20 to 800 acres in size.

The surface layer is brown loam about 12 inches thick. The next layer is pinkish-gray clay loam about 22 inches thick. The next lower layer is pink silty clay loam that extends to a depth of 60 inches (fig. 11).

Included with this soil in mapping are areas of Angelo soils that make up about 5 percent of the total area of this mapping unit. Also included are areas of loamy, highly calcareous soils that are shallow over cemented caliche. These soils make up 3 percent of the area.

This soil is used equally for crops and for range. Cotton, grain sorghum, and small grain are the main crops.

The hazards of soil blowing and water erosion are slight. The main concern of management is maintenance of good tilth. Leaving crop residue on the surface helps to improve tilth. Level terraces are effectively used for water conservation. If this soil is irrigated, a system that controls loss of soil and water

Figure 11.—**Profile of Tulia loam, 0 to 1 percent slopes.**

is needed. Dryland capability unit IIIe-3 and irrigated capability unit I-2; Hardland Slopes range site.

Tulia loam, 1 to 3 percent slopes (TuB).—This soil is mainly in areas between the higher, nearly level uplands and the lower lying flood plains of the larger streams. In places it is on gently sloping foot slopes of limestone hills.

This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of loamy, calcareous soils that are shallow over cemented caliche. These soils make up 13 percent of the total area of this mapping unit. Also included are areas of similar soils that have 35 to 40 percent clay in their lower layers.

This soil is used equally for crops and for range. Cotton, grain sorghum, and small grain are the main crops.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate. Terraces and contour farming help to control water erosion. Division terraces and grassed waterways are needed in places to control water from higher lying soils. If this soil is irrigated, a system that controls loss of soil and water is needed. Dryland capability unit IIIe-2 and irrigated capability unit IIe-1; Hardland Slopes range site.

Tulia loam, 3 to 5 percent slopes (TuC).—This soil is mainly in areas that extend from uplands to the lower lying flood plains of rivers and major tributaries. It is also on foot slopes of steeper limestone hills.

The surface layer is grayish-brown clay loam about 6 inches thick. The next layer is pinkish-gray clay loam about 10 inches thick. The next lower layer is pink silty clay loam that extends to a depth of 60 inches. A few areas are gullied at intervals of 100 to 300 yards. These gullies are 1 to 3 feet deep and 3 to 15 feet wide.

Included with this soil in mapping are areas of loamy calcareous soils that are shallow over cemented caliche. They make up about 5 percent of the total area of this mapping unit. Also included are areas of deep, light-colored soils that have 35 to 40 percent clay in the subsoil, which make up about 5 percent, and of Berda soils, which make up about 5 percent.

Most of the acreage of this soil is in range. If this soil is cropped, it is better suited to such close-growing crops as small grain or sorghum in close-spaced rows than to most other crops.

The hazard of soil blowing is slight, and the hazard of water erosion is severe. Terraces and contour farming help to control water erosion, and leaving crop residue on the surface helps to reduce runoff. Diversion terraces and grassed waterways are needed in places to control runoff from other soils. Dryland capability unit IVe-2; Hardland Slopes range site.

Tulia-Urban land complex, 0 to 5 percent slopes (TvC).—This complex consists of 60 percent Tulia soils and 40 percent Urban land. The percentage of Urban land in mapped areas ranges from 25 to 50 percent. Areas of Tulia soils and Urban land are so intermingled or so small in size that they cannot be shown separately at the scale mapped.

The surface layer of the Tulia soils is brown clay loam about 12 inches thick. The next layer is pinkish-gray clay loam about 10 inches thick. The underlying material is pink silty clay loam that extends to a depth of 60 inches. A few areas of these soils have been altered by the addition of 1 to 3 inches of imported topsoil (fig. 12).

Figure 12.—**Area of Tulia-Urban land complex, 0 to 5 percent slopes. The landscape has been altered, and the soil horizonation has been destroyed.**

Urban land is made up of streets, single-unit dwellings, driveways, sidewalks, business buildings, schools, churches, and parking lots. Before urban development, these areas were dominantly Tulia soils. The soils in these areas have been so altered by urban works, construction, and earthmoving that identification is not practical.

Corrosivity of Tulia soils to uncoated steel is moderate. These soils have moderate traffic-supporting capacity for streets.

Tulia soils are suitable for most landscaping plants used in the county. Not placed in a capability unit or range site.

Urban Land

Urban land (Ur) consists of areas where the soils have been so altered by urban works, construction, and earthmoving that their identification is not practical. Urban land is mostly in the city of San Angelo. About 75 percent of the surface of this land type is covered by buildings, streets, and parking lots. Most areas of the original soils have been altered by excavation or covered by contrasting material. Slopes range from 0 to 8 percent. Not placed in a capability unit or range site.

Use and Management of the Soils

In this section the management of the soils for crops is discussed, the system of capability grouping used by the Soil Conservation Service is explained, and the irrigated and dryland capability units are listed. Also given in this section are the estimated yields of the principal crops, the management of the soils for range, the use and management of the soils for wildlife habitat, and the engineering uses of the soils.

Management of the Soils for Crops

Most crops on dryfarmed soils do not need commercial fertilizer, but crops on irrigated soils do benefit from its use. Crops on irrigated soils and plants around homes respond favorably to phosphate and nitrogen fertilizers. Most of the soils in the survey area are calcareous, and much of the phosphate in the soils is unavailable to plants. For this reason, phosphate fertilizers should be concentrated in small areas, either in pellets or bands. Potassium fertilizer generally is not needed.

Most of the gently sloping soils used for crops need field terraces for the control of erosion. Nearly all the soils used for crops benefit from the use of field terraces for water conservation. Field terraces generally are level and have their ends partly blocked to impound some water. Most new terraces are made parallel in order to more readily accommodate large equipment.

Most crops can tolerate the low rainfall and high evaporation rate of this area. Grain sorghum, cotton, wheat, and oats are the most important crops. Many other crops could be grown if the soils were irrigated. Cantaloupes, watermelons, cucumbers, onions, okra, pecans, grapes, alfalfa, apricots, and corn, as well as bermudagrass pasture, are all grown successfully with irrigation.

More information on the use and management of soils used for crops can be found in the section "Descriptions of the Soils."

Capability grouping

Some readers, particularly those who farm on a large scale, may find it practical to use and manage some of the different kinds of soil on their farm in the same way. These readers can make good use of the capability classification system, a grouping that shows, in a general way, the suitability of soils for most kinds of farming.

The grouping is based on permanent limitations of soils when used for field crops; the risk of damage when they are farmed; and the way the soils respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops that require special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations for range or for engineering.

In the capability system, all the soils are grouped at three levels: the class, the subclass, and the unit. The broadest grouping, the capability class, is designated by Roman numerals I to VIII. In class I are the soils that have the fewest limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are the soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products. The subclass indicates major kinds of limitations within the classes. Within most of the classes there can be up to 4 subclasses. The subclasses are indicated by adding a small letter *e*, *w*, *s*, or *c* to the class numeral, for example, IIe. The letter "e" shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; "*w*" means that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); "*s*" shows that the soil is limited mainly because it is shallow, droughty, or stony; and "*c*" indicates that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c*, because the soils are subject to little or no erosion but have other limitations that confine their use largely to pasture, range, or wildlife.

Subclasses are further divided into groups called capability units. These are groups of soils that are so

much alike that they are suited to the same crops and pasture plants, require about the same management, and have generally similar productivity and other response to management. Capability units are generally identified by numbers assigned locally, for example, IIe–1 or IIIs–2.

The eight classes in the capability system and the subclasses and units in Tom Green County are described in the list that follows.

Irrigated Capability Units

Class I. Soils that have few limitations that restrict their use (no subclasses).

Unit I–1. Deep, nearly level, well-drained soils that are moderately slowly permeable.

Unit I–2. Deep, nearly level, well-drained soils that are moderately permeable.

Unit I–3. Deep, nearly level to gently sloping, well drained to moderately well drained soils that are moderately permeable to slowly permeable

Class II. Soils that have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Subclass IIe. Soils that are subject to moderate erosion unless protected.

Unit IIe–1. Deep, gently sloping, well drained to moderately well drained soils that are moderately permeable to very slowly permeable.

Unit IIe–2. Moderately deep, gently sloping, well-drained soils that are moderately permeable.

Subclass IIs. Soils that are moderately limited because of permeability or depth.

Unit IIs–1. Deep, nearly level, moderately well drained soils that are very slowly permeable.

Unit IIs–2. Shallow, nearly level, well-drained soils that are moderately slowly permeable.

Class III. Soils that have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Subclass IIIe. Soils that are subject to severe erosion if they are cultivated and not protected.

Unit IIIe–1. Deep, gently sloping, well-drained soils that are moderately permeable.

Unit IIIe–2. Shallow, gently sloping, well-drained soils that are moderately slowly permeable to very slowly permeable in the petrocalcic horizon.

Subclass IIIs. Soils that are severely limited because of depth and permeability.

Unit IIIs–1. Shallow, nearly level, well-drained soils that are slowly permeable to very slowly permeable in the petrocalcic horizon.

Dryland Capability Units

Class I. Soils that have few limitations that restrict their use (none in Tom Green County).

Class II. Soils that have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Subclass IIc. Soils that are moderately limited because of climate (low rainfall).

Unit IIc–1. Deep, nearly level to gently sloping, well drained to moderately well drained soils that are moderately permeable to slowly permeable.

Unit IIc–2. Deep, nearly level, well-drained soils that are moderately slowly permeable.

Class III. Soils that have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Subclass IIIc. Soils that are severely limited because of climate (low rainfall).

Unit IIIc–1. Deep, nearly level, well-drained soils that are moderately slowly permeable.

Subclass IIIe. Soils that are subject to severe erosion if they are cultivated and not protected.

Unit IIIe–1. Deep, gently sloping, well drained to moderately well drained soils that are moderately slowly permeable to very slowly permeable.

Unit IIIe–2. Deep to moderately deep, well-drained soils that are moderately permeable.

Unit IIIe–3. Deep, nearly level, well-drained soils that are moderately permeable to moderately slowly permeable.

Unit IIIe–4. Shallow, gently sloping, well-drained soils that are moderately slowly permeable to very slowly permeable in the petrocalcic horizon.

Subclass IIIs. Soils that are severely limited because of depth and permeability.

Unit IIIs–1. Shallow, nearly level, well-drained soils that are moderately slowly permeable.

Unit IIIs–2. Deep, nearly level, moderately well drained soils that are very slowly permeable.

Unit IIIs–3. Shallow, nearly level, well-drained soils that are slowly permeable to very slowly permeable in the petrocalcic horizon.

Subclass IIIw. Soils that are severely limited for cultivation because of excess water.

Unit IIIw–1. Deep, nearly level, moderately well drained soils that are very slowly permeable.

Class IV. Soils that have very severe limitations that reduce the choice of plants, require very careful management, or both.

Subclass IVe. Soils that are subject to very severe erosion if they are cultivated and not protected.

Unit IVe–1. Shallow to very shallow, nearly level to gently sloping, well-drained soils that are moderately permeable to moderately slowly permeable.

Unit IVe–2. Deep, gently sloping to sloping, well-drained soils that are moderately permeable.

Class V. Soils that are not likely to erode but that have other limitations that are impractical to remove and that limit their use largely to pasture, range, woodland, or wildlife habitat (none in Tom Green County).

Class VI. Soils that have severe limitations that make them generally unsuited to cultivation and that limit their use largely to pasture, range, or wildlife habitat.

Subclass VIe. Soils that are severely limited, chiefly by risk of erosion, unless protective cover is maintained.

Unit VIe–1. Shallow to very shallow, gently sloping to sloping, well drained to moderately well drained soils that are moderately permeable to slowly permeable.

Subclass VIw. Soils that are subject to frequent flooding.

Unit VIw–1. Deep, nearly level to gently sloping, well drained to moderately well drained soils that are slowly permeable to moderately rapidly permeable.

Class VII. Soils that have very severe limitations that make them unsuited to cultivation and that restrict their use largely to range or wildlife habitat.

Subclass VIIs. Soils that are very severely limited by shallow depth and stoniness.

Unit VIIs–1. Very shallow to shallow, gently sloping to sloping, well-drained soils that are very slowly permeable to moderately permeable.

Unit VIIs–2. Very shallow to shallow, undulating to hilly, well drained to moderately well drained soils that are moderately permeable to very slowly permeable.

Class VIII. Soils and landforms that have limitations that preclude their use for commercial plants and that restrict their use to recreation, wildlife habitat, or water supply, or to esthetic purposes (none in Tom Green County).

Predicted yields

In table 2 the estimates of yields of the principal crops grown in the county are listed. The yields are based on estimates made by farmers, soil scientists, and others who have knowledge of yields in the county, and on information taken from research data. The predicted yields given in the table are the average yields per acre that can be expected at a level of management that results in the highest economic returns.

The yields are given for both dryland and irrigated soils where both methods of farming are used. If only one method is practical, yields for only that method of farming are given. The soils that are used only as range or for recreation are not included in this table.

Crops other than those shown in table 2 are grown in the county, but their predicted yields are not included, because their acreage is small or because reliable data on yields are not available.

The predicted yields given in table 2 can be ex-

TABLE 2.—*Predicted yields per acre of principal dryland and irrigated crops*

[Absence of a yield figure indicates the crop is not commonly grown on the soil]

Soil	Dryland			Irrigated	
	Cotton	Grain sorghum	Wheat	Cotton	Grain sorghum
	Lbs of lint	*Lbs*	*Bu*	*Lbs of lint*	*Lbs*
Amarillo fine sandy loam, 3 to 5 percent slopes	150	750	10	600	4,000
Angelo clay loam, 0 to 1 percent slopes	250	1,750	20	1,000	6,000
Angelo clay loam, 1 to 3 percent slopes	200	1,500	15	950	5,700
Angelo silty clay, 0 to 1 percent slopes	250	1,750	20	950	5,700
Angelo silty clay, 1 to 3 percent slopes	200	1,500	15	950	5,700
Cobb fine sandy loam, 1 to 3 percent slopes	150	1,250	15	600	4,000
Estacado loam, 0 to 1 percent slopes	200	1,500	15		
Estacado loam, 1 to 3 percent slopes	150	1,250	15		
Kavett clay, 0 to 1 percent slopes	200	1,250	15	650	4,500
Kavett clay, 1 to 3 percent slopes	150	1,000	15	600	4,000
Lipan clay	250	1,000		950	5,700
Mereta clay loam, 0 to 1 percent slopes	200	1,250	15	650	4,500
Mereta clay loam, 1 to 3 percent slopes	150	1,250	15	600	4,000
Olton clay loam, 0 to 1 percent slopes	200	1,500	15	1,000	6,000
Olton clay loam, 1 to 3 percent slopes	200	1,500	15	950	5,700
Rioconcho clay loam	250	2,000	15	800	5,500
Rioconcho and Spur soils	275	2,000	20	1,000	6,200
Rotan clay loam, 0 to 1 percent slopes	275	2,000	20	1,000	6,000
Slaughter clay loam, 1 to 3 percent slopes	150	1,000	15	600	4,000
Tobosa clay, 0 to 1 percent slopes	250	1,750	20	950	5,700
Tobosa clay, 1 to 3 percent slopes	200	1,500	15	900	5,500
Tulia loam, 0 to 1 percent slopes	175	1,500	10	950	5,800
Tulia loam, 1 to 3 percent slopes	150	1,000	10	800	5,200
Tulia loam, 3 to 5 percent slopes	125	750	10		

pected if the following dryland management practices are used.

1. Rainfall is effectively used and conserved.
2. Surface drainage systems, subsurface drainage systems, or both, are installed.
3. Crop residue is managed to maintain soil tilth.
4. Minimum but timely tillage is used.
5. Insect, disease, and weed control measures are consistently used.
6. Fertilizer is applied according to soil tests and crop needs.
7. Adapted crop varieties are used at recommended seeding rates.

If the soils are irrigated, the following additional practices must be used.

8. Irrigation water of suitable quality is used.
9. Irrigation is timed to meet the need of the soil and crop.
10. Irrigation systems are properly designed and efficiently used.

Range [2]

Tom Green County has about 712,000 acres of range. The most extensive tracts are in areas of limestone, where a large acreage of the soils is hilly and very shallow. In these areas, many kinds of woody plants, grasses, and forbs supply forage for sheep, cattle, and deer. The most productive soils are on the flood plains of the streams of the county. These areas greatly benefit from the extra water they receive in the form of runoff from higher lying soils. About two-thirds of the acreage on flood plains is used as range. About 200,000 acres of deep soils that are suitable for cultivation are used as range.

Range sites and condition classes

Soils vary in their capacity to produce grass and other plants for grazing. Soils that produce about the same kinds and amounts of vegetation make up a range site.

Range sites are determined by differences in the capacity of rangeland to produce vegetation. The soils of a range site produce about the same kind of climax vegetation. Climax vegetation is the stabilized plant community. It reproduces itself and does not change as long as the environment is unchanged. Generally, the climax vegetation consists of the plants that were growing on a site before the natural order was changed. The most productive combination of forage plants on a range site generally is the climax vegetation.

Decreasers are plants in the climax vegetation that tend to decrease in relative amount when the site is under close grazing. They generally are the tallest and most productive perennial grasses and forbs and the most palatable to livestock.

Increasers are plants in the climax vegatation that increase in relative amount as the more desirable plants are reduced by close grazing. They commonly are shorter than decreasers and generally are less palatable to livestock.

Invaders are plants that cannot compete with plants in the climax plant community for moisture, nutrients, and light. Hence, invaders come in and grow along with increasers after the climax vegetation has been reduced by grazing. Many are annual weeds, and some are shrubs that have some grazing value, but others have little value for grazing.

Four range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation brought about by grazing or other uses. The classes show the degree that the present vegetation on a range site differs from the native vegetation that could grow there.

A range is in *excellent* condition if 76 to 100 percent of the vegetation is the same kind as that in the climax stand. It is in *good* condition if it is 51 to 75 percent; in *fair* condition if it is 26 to 50 percent; and in *poor* condition if it is 25 percent or less.

Potential forage production depends on the range site. Current forage production depends on the range condition and the moisture available to plants during their growing season.

An important objective of good range management is to keep the range in excellent or good condition. If this is done, water is conserved, yields are improved, and the soils are protected. The major problem in management is recognizing important changes in the kind of cover on a range site. These changes take place gradually and can be misinterpreted or overlooked. The growth of plants that are encouraged by heavy rainfall may lead to the conclusion that the range is in good condition, when actually the cover is weedy and the long-term trend is toward lower production. On the other hand, some rangeland that has been closely grazed for short periods under the supervision of a careful manager may have a degraded appearance that temporarily conceals its quality and capacity to recover.

Descriptions of the range sites

In the following pages the range sites of Tom Green County are described and the climax plants and principal invaders on the sites are named. Also given is an estimate of the potential annual yield of air-dry herbage for each site if it is in excellent condition. The soils in each site can be determined by referring to the "Guide to Mapping Units" at the back of this survey.

BOTTOM LAND RANGE SITE

In this site are deep soils that formed in alluvium. These soils are sometimes flooded. They have high to medium available water capacity and slow to moderately rapid permeability.

The areas of this site that have flowing streams have ground water that is within the reach of many plants. As a result of this condition, trees are able to grow on the soils in these areas. A large quantity of nutritious and palatable forage is able to grow on the

[2] By R. J. PEDERSON, range conservationist, Soil Conservation Service.

soils of this site even in areas where there is partial shading.

The grasses, forbs, and trees that make up the climax plant community vary because of differences in the amount of flooding, in the water table, and in the stream channel. The lower swales and the flood plain generally are the most productive areas. The climax plant community is 20 percent side-oats grama, 10 percent buffalograss, 10 percent cane bluestem, 15 percent vine-mesquite, 5 percent little bluestem and indiangrass, 10 percent Canada wildrye and Texas wintergrass, 5 percent false switchgrass, 15 percent other grasses, 5 percent annual and perennial forbs, and 5 percent hackberry, willow, black walnut, and pecan.

The taller grasses, such as cane bluestem, side-oats grama, and Canada wildrye, decrease under continuous heavy grazing and buffalograss increases. Mesquite invades readily and becomes dominant.

If this site is in excellent condition, the average annual production of air-dry herbage ranges from 1,800 pounds per acre in unfavorable years to 4,000 pounds per acre in favorable years.

CLAY LOAM RANGE SITE

In this site are deep soils that have a loamy and clayey surface layer. These soils have high available water capacity and moderately slow permeability.

Deep-rooted perennial plants grow on the soils in this site, and forage production is good in years of above-average rainfall. In years of less rainfall, plants do not grow so well, because much moisture is lost through evaporation.

The climax plant community is an open grassland. It is 35 percent side-oats grama, 20 percent buffalograss, 15 percent cane bluestem, 10 percent tobosa, 10 percent vine-mesquite, 5 percent three-awn, and 5 percent annual and perennial forbs.

Side-oats grama decreases under continuous heavy grazing and buffalograss increases. Mesquite readily invades this site, and this results in a decrease in the production of forage. This site can be reseeded successfully.

If this site is in excellent condition, the average annual production of air-dry herbage ranges from 1,400 pounds per acre in unfavorable years to 4,000 pounds per acre in favorable years.

HARDLAND SLOPES RANGE SITE

In this site are deep, loamy soils. These soils have high available water capacity and moderate permeability.

The climax plant community is an open grassland. It is 35 percent side-oats grama, 20 percent buffalograss, 15 percent cane bluestem, 10 percent black grama, 5 percent three-awn, 10 percent sand dropseed, and 5 percent annual and perennial forbs.

Side-oats grama decreases under continuous heavy grazing and buffalograss increases. Mesquite readily invades this site, and this results in a decrease in the production of forage. This site can be reseeded successfully.

If this site is in excellent condition, the average annual production of air-dry herbage ranges from 1,300 pounds per acre in unfavorable years to 2,500 pounds per acre in favorable years.

HEAVY CLAY RANGE SITE

In this site are clayey soils that are susceptible to shrinking and swelling and have a cracked, uneven surface. Water can penetrate deeply into the cracks initially, but the soil generally is very slowly permeable. Available water capacity is high.

The climax plant community is mainly short grasses. It is 30 percent buffalograss and curly-mesquite, 15 percent side-oats grama, 15 percent tobosa, 20 percent vine-mesquite, 5 percent Texas wintergrass, 5 percent bluestem, 5 percent annual forbs and grasses, and 5 percent scarce perennial forbs and other grasses.

Buffalograss and curly-mesquite increase under continuous heavy grazing and dominate the plant community. Mesquite is the most common invader. This site is very difficult to reseed.

If this site is in excellent condition, the average annual production of air-dry herbage ranges from 2,000 pounds per acre in unfavorable years to 3,500 pounds per acre in favorable years.

LAKEBED RANGE SITE

In this site are deep, clayey soils. This site is a closed depressional area that has concave slopes. These soils have high available water capacity and very slow permeability.

Water that runs onto the soils of this site from the surrounding higher lying soils collects on the site and remains for a few days or a few months. This ponding kills most of the vegetation; consequently, the most abundant vegetation commonly is quick-maturing annuals. The kind and amount of vegetation on this site depend on the depth of the ponded water and the frequency of flooding.

The climax plant community is 40 percent buffalograss, 20 percent white tridens, 10 percent vine-mesquite, 15 percent annual forbs and grasses, 10 percent sedges, and 5 percent knotgrass. Buffalograss increases under continuous heavy grazing and dominates the plant community. Weeds such as bitterweed can be a problem in years of above-average rainfall.

If this site is in excellent condition, the average annual production of air-dry herbage ranges from 800 pounds per acre in unfavorable years to 2,500 pounds per acre in favorable years.

LOW STONY HILL RANGE SITE

In this site are shallow to very shallow, cobbly, clayey soils. These soils have low available water capacity and moderately slow permeability. Coarse fragments are common on the surface.

Water from even small rains runs from the stones and rocky areas into cracks and crevices and provides moisture for plant growth. Because evaporation is less on north-facing slopes, production is greater there. Runoff is rapid.

The savanna of oak, shrubs, grasses, and forbs that makes up the climax plant community is useful to sheep, cattle, goats, and deer (fig. 13). The climax

Figure 13.—**Low Stony Hill range site on a Tarrant soil.**

plant community is 30 percent side-oats grama, 5 percent little bluestem; 10 percent green sprangletop; 10 percent live oak, shin oak, sumac, elbowbush, hackberry, and other shrubs; 10 percent perennial forbs; 5 percent annual grasses and forbs; 10 percent such other grasses as buffalograss and curly-mesquite; and 20 percent fall witchgrass, three-awn, hairy and slim tridens, and hairy grama.

The palatable perennial forbs and grasses, such as side-oats grama and green sprangletop, decrease under continuous heavy grazing, and short grasses, such as hairy tridens, increase. Juniper and some unpalatable annual plants invade. The rough terrain makes the use of mechanical equipment difficult, but brush control is successful in places. Seeding generally is not needed, because many of the better species persist in the stony soil and are a seed source.

If this site is in excellent condition, the average annual production of air-dry herbage ranges from 900 pounds per acre in unfavorable years to 1,700 pounds per acre in favorable years.

SANDSTONE HILL RANGE SITE

In this site are shallow to very shallow, loamy soils. These soils have low available water capacity and slow to moderate permeability. The hazards of soil blowing and water erosion are moderate.

The climax plant community is a savanna of post oak, grasses, and forbs. It is 15 percent green sprangletop; 15 percent hooded windmillgrass; 10 percent side-oats grama; 10 percent slim tridens; 5 percent fringeleaf paspalum, 25 percent other grasses; 10 percent annual and perennial forbs; 10 percent post oak and live oak; and small amounts of catclaw and other low brush.

Perennial grasses decrease under continuous heavy grazing, and annual forbs increase.

If this site is in excellent condition, the average annual production of air-dry herbage ranges from 800 pounds per acre in unfavorable years to 1,700 pounds per acre in favorable years.

SANDY LOAM RANGE SITE

In this site are deep, to moderately deep, loamy soils. These soils have medium to high available water capacity and moderate permeability.

The climax plant community is open grassland and a few shrubs. It is 20 percent side-oats grama, 10 percent cane bluestem; 10 percent slim tridens; 10 percent hooded windmillgrass; 5 percent fringeleaf paspalum; 5 percent three-awn; 5 percent fall witchgrass; 5 percent reverchon and panicum; 5 percent black grama; 17 percent other grasses; 8 percent annual and perennial forbs, and 5 percent yucca, a few post oaks, and low shrubs (fig. 14).

Practices of range management such as mechanical brush control and range seeding are effective on this site.

If this site is in excellent condition, the average annual production of air-dry herbage ranges from 1,400 pounds per acre in unfavorable years to 2,400 pounds per acre in favorable years.

SHALLOW RANGE SITE

In this site are shallow, clayey to loamy soils. These soils have low available water capacity. Permeability is moderately slow to very slow in the hard caliche horizon.

The climax plant community is grassland. It is 20 percent curly-mesquite and buffalograss; 20 percent side-oats grama; 5 percent cane bluestem; 10 percent slim tridens; 10 percent fall witchgrass; 10 percent three-awn; 20 percent other grasses; 5 percent annual and perennial forbs, and minor amounts of live oak.

Mesquite, agrito, condalia, and juniper are common invaders. Practices of range management such as mechanical brush control and reseeding are effective on this site.

If this site is in excellent condition, the average annual production of air-dry herbage ranges from 1,200 pounds per acre in unfavorable years to 2,500 pounds per acre in favorable years.

SHALLOW CLAY RANGE SITE

In this site are shallow, clayey soils. These soils have low available water capacity and very slow permeability. Vegetation is difficult to reestablish in bare eroded areas, where the surface is sealed so that water cannot penetrate.

The climax plant community is mainly short grasses. It is 40 percent curly-mesquite; 10 percent buffalograss; 10 percent vine-mesquite; 5 percent three-awn; 5 percent annuals; 5 percent slim tridens; 5 percent perennial forbs, and 20 percent other plants.

Curly-mesquite increases and becomes dominant if this site is overgrazed. Mesquite invades in places. This site is difficult to reseed successfully.

If this site is in excellent condition, the average annual production of air-dry herbage ranges from 1,000 pounds per acre in unfavorable years to 2,000 pounds per acre in favorable years.

SHALLOW HILLS RANGE SITE

In this site are very shallow to shallow, very gravelly, loamy soils. These soils have low available water capacity and moderate permeability. Runoff is rapid.

The underlying limestone has a continuous caliche coating that resists deep penetration of roots or water. This limits the site to shallow-rooted plants.

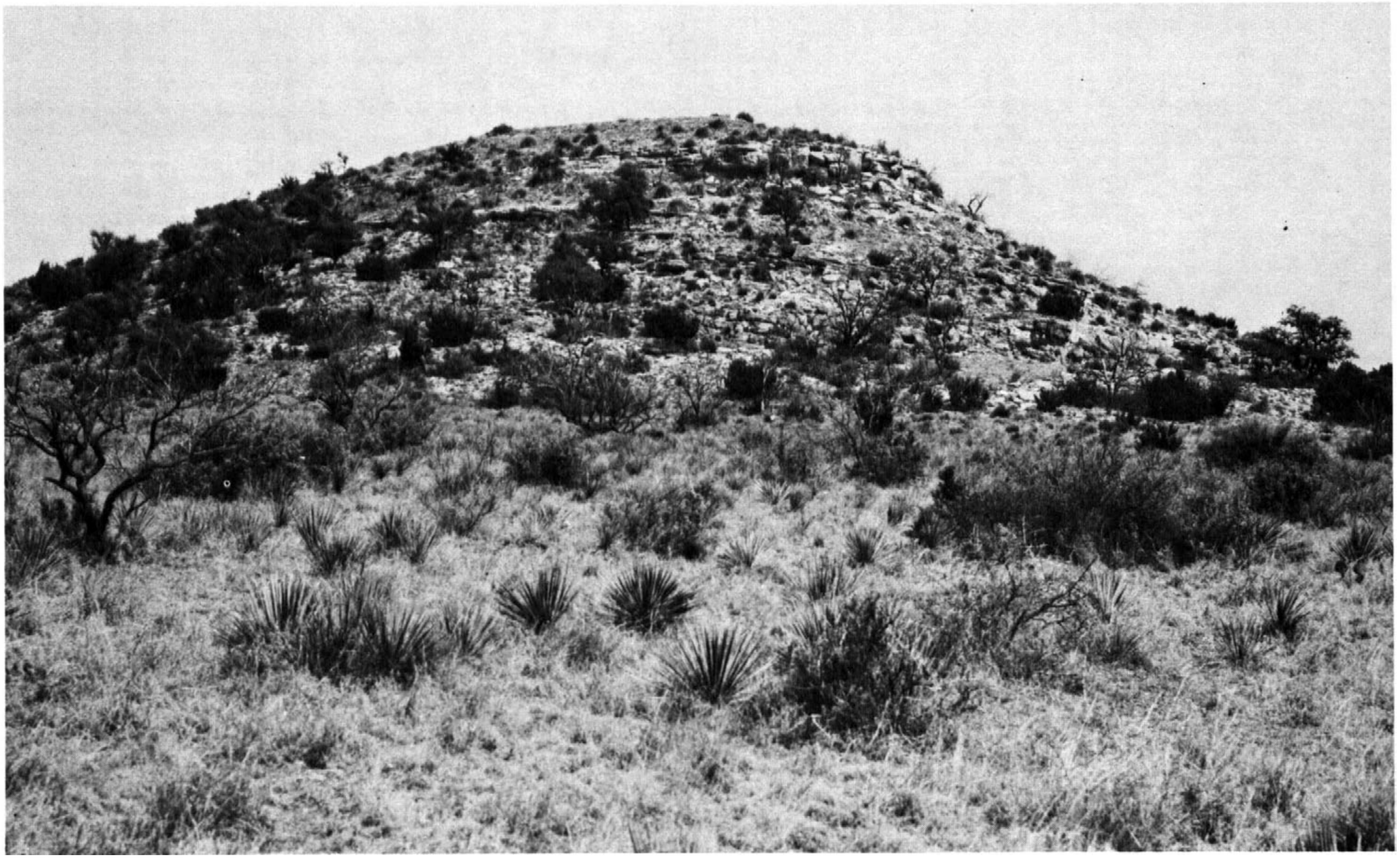

Figure 14.—Area of Sandy Loam range site in foreground is on an Amarillo soil. The yucca is typical of this site.

The climax plant community is a grassland. It is 25 percent side-oats grama; 15 percent green sprangletop; 10 percent slim tridens; 5 percent fall witchgrass; 13 percent other grasses; 10 percent annual and perennial forbs, and 2 percent feather dalea and other shrubs.

Juniper is a common invader, and pricklypear and tasajillo increase and invade. Seedbeds can be prepared successfully on this site.

If this site is in excellent condition, the average annual production of air-dry herbage ranges from 400 pounds per acre in unfavorable years to 800 pounds per acre in favorable years.

VERY SHALLOW RANGE SITE

In this site are very shallow to shallow, gravelly, loamy soils. These soils have low available water capacity and moderate permeability.

The climax plant community is an open grassland. It is 15 percent side-oats grama; 5 percent curly-mesquite; 15 percent slim tridens; 5 percent fall witchgrass; 10 percent three-awn; 10 percent reverchon and bristle panicum; 15 percent green sprangletop; 13 percent other grasses; 10 percent annual and perennial forbs, and 2 percent feather and black dalea and catclaw.

Juniper, mesquite, agrito, and condalia invade this site if it is overgrazed. Practices of range management such as reseeding and using mechanical equipment are effective on this site.

If this site is in excellent condition, the average annual production of air-dry herbage ranges from 200 pounds per acre in unfavorable years to 500 pounds per acre in favorable years.

Wildlife

Tom Green County has several kinds of wildlife habitat. In some areas there is an oak-juniper cover and many other kinds of vegetation. In other areas mesquite is dominant and ground cover is short. Still other areas are quite open and have only scattered low shrubs. Some areas are entirely in crops, and some are a mixture of crops and range. Three large manmade lakes supply habitat for water birds and shore birds as well as for fish. The water level fluctuates considerably from year to year.

More than 280 species of birds have been recorded in the county. Some of the animals in the county are deer, raccoons, skunks, cottontail rabbits, jackrabbits, fox squirrels, gray and red foxes, opossums, badgers, javelina, coyotes, and bobcats. In the streams and lakes, there are channel catfish, yellow catfish, black bass, sunfish, and other fish.

Hunting leases, which are paid agreements between landowners and hunters for hunting privileges, are becoming commonplace. The most popular game animals

are deer, turkey, quail, and doves. An increasing amount of attention is directed toward habitat preservation and habitat development.

Use of the soils for wildlife habitat

Soils influence the kind and amount of vegetation and the amount of water available, and, in this way, influence the kinds of wildlife that can live in an area. Soil properties that affect the growth of wildlife habitat are: (1) thickness of soil useful to crops, (2) surface texture, (3) available water capacity to a depth of 40 inches, (4) wetness, (5) surface stoniness or rockiness, (6) flood hazard, (7) slope, and (8) permeability of the soil to air and water.

In table 3, the soils in the survey area are rated for four elements of wildlife habitat and for two groups, or kinds, of wildlife. The ratings indicate relative suitability for various elements.

The levels of suitability are expressed by an adjective rating. *Good* indicates that habitats are easily improved, maintained, or created. There are few or no soil limitations in habitat management, and satisfactory results can be expected. *Fair* indicates that habitats can be improved, maintained, or created on these soils, but moderate soil limitations affect habitat management or development. A moderate intensity of management and fairly frequent attention may be required to ensure satisfactory results. *Poor* indicates that habitats can be improved, maintained, or created on these soils, but the soil limitations are severe. Habitat management may be difficult and expensive and require intensive effort. Results are uncertain. *Very poor* indicates that under the prevailing soil conditions it is impractical to attempt to improve, maintain, or create habitats. Unsatisfactory results are probable.

Each soil is rated according to its suitability for producing various kinds of plants. Other elements that make up wildlife habitat are also considered. The ratings mainly take into account the characteristics of the soils and closely related natural factors of the environment. They do not take into account present use of soils or present distribution of wildlife and people.

TABLE 3.—*Suitability of soils for elements of wildlife habitat and kinds of wildlife*

Soil series and map symbols	Elements of wildlife habitat				Kinds of wildlife	
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Shrubs	Open-land	Rangeland
Amarillo: AmC	Fair	Good	Fair	Fair	Fair	Fair.
Angelo: AnA, AnB, AoA, AoB, AuB	Fair	Fair	Fair	Fair	Fair	Fair.
Urban land part of AuB is too variable to be rated.						
Berda: BeD	Fair	Good	Fair	Fair	Fair	Fair.
Cobb: CoB	Fair	Good	Fair	Fair	Fair	Fair.
Cosh: CsD	Poor	Fair	Fair	Poor	Fair	Poor.
For Latom part, see Latom series.						
Dev: Dr	Poor	Poor	Fair	Good	Poor	Fair.
For Rioconcho part, see Rioconcho series.						
Ector: EcC, EcE	Very poor	Very poor	Fair	Fair	Poor	Fair.
Estacado: EsA, EsB	Fair	Good	Fair	Fair	Fair	Fair.
Kavett: KaA, KaB	Fair	Fair	Poor	Poor	Fair	Poor.
Kimbrough: KmC, KoD, KuD	Very poor	Very poor	Poor	Poor	Poor	Poor.
For Owens part of KoD, see Owens series; Urban land part of KuD is too variable to be rated.						
Latom	Poor	Poor	Poor	Poor	Poor	Poor.
Mapped only in a complex with Cosh soils.						
Lipan: Lc	Fair	Fair	Poor	Fair	Fair	Poor.
Mereta: MeA, MeB, MuB	Fair	Fair	Fair	Poor	Fair	Poor.
Urban land part of MuB is too variable to be rated.						
Olton: OlA, OlB, OuB	Fair	Good	Fair	Fair	Fair	Fair.
Urban land part of OuB is too variable to be rated.						
Owens	Very poor	Very poor	Poor	Poor	Poor	Poor.
Mapped only in a complex with Kimbrough soils.						
Rioconcho: Rn, Rs	Good	Good	Fair	Good	Good	Fair.
For Spur part of Rs, see Spur series.						
Rotan: RtA	Good	Good	Fair	Good	Good	Fair.
Slaughter: ShB, SkA, SuA	Fair	Fair	Fair	Poor	Fair	Poor.
For Kimbrough part of SkA, see Kimbrough series; Urban land part of SuA is too variable to be rated.						
Spur	Good	Good	Fair	Good	Good	Fair.
Mapped only in an undifferentiated group with Rioconcho soils.						
Tarrant: TaC, TaE	Very poor	Very poor	Good	Good	Poor	Good.
Tobosa: ToA, ToB	Fair	Fair	Poor	Poor	Fair	Poor.
Tulia: TuA, TuB, TuC, TvC	Fair	Good	Fair	Fair	Fair	Fair.
Urban land part of TvC is too variable to be rated.						
Urban land: Ur.						
Too variable to be rated.						

For this reason, selection of a site for development as a habitat for wildlife requires inspection of the site.

The elements of wildlife habitat rated in table 3 are briefly described in the following paragraphs.

Grain and seed crops are annual grain-producing plants, such as corn, sorghum, millet, and soybeans.

Grasses and legumes are domestic grasses and legumes that are established by planting. They provide food and cover for wildlife. Grasses include ryegrass and panicgrass; legumes include clovers and peas.

Wild herbaceous upland plants are native or planted perennial grasses, forbs, and weeds that provide food and cover for upland wildlife. Beggarweed, wildbean, pokeweed, and cheatgrass are typical examples. On rangeland, typical plants are bluestem, grama, perennial forbs, and legumes.

Shrubs are shrubs, trees, and woody vines that produce food for wildlife in the form of fruits, nuts, buds, catkins, or browse. Such plants commonly grow in their natural environment, but they may be planted and developed through wildlife management programs. The typical species in this category are oak, grape, greenbrier, mesquite, catclaw, and whitebrush.

The soils are also rated according to their suitability as habitat for the two kinds of wildlife in the county—open-land and rangeland wildlife. These ratings are related to the ratings made for the elements of wildlife habitat.

Open-land wildlife consists of birds and mammals that normally live in meadows, pastures, and open areas where grasses, herbs, and shrubby plants grow. Quail, doves, meadowlarks, field sparrows, cottontail rabbits, and foxes are typical examples of open-land wildlife.

Rangeland wildlife consists of birds and mammals that normally live in wooded areas of hardwood trees, coniferous trees, and shrubs. Wild turkeys, deer, squirrels, and raccoons are typical examples of rangeland wildlife.

The soils of this county are not well suited to the development of habitat for wetland wildlife. However, it is possible to develop areas of Lipan clay for wetland wildlife, especially where irrigation water is available. Wetland wildlife consists of birds and mammals that normally live in wet areas, marshes, and swamps. Ducks, geese, rails, shore birds, and herons are typical examples of wetland wildlife.

There are two kinds of habitat for wetland wildlife. In the first kind, called wetland food and cover plants, are annual and perennial herbaceous plants that grow wild on moist and wet sites. Typical examples of plants are smartweed, wild millet, spikrush and other rushes, sedges, burreed, tearthumb, and aneilema. Submerged and floating aquatics are not included in this catgory. In the second kind, shallow water developments, there are impoundments or excavations for controlling water, generally not more than 5 feet deep, to create habitats that are suitable for waterfowl. Some of these developments are designed to be drained, planted, and then flooded; others are permanent impoundments in which submersed aquatics grow.

Engineering Uses of the Soils [3]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, soil drainage condition, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are depth to the water table, depth to bedrock, and soil slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evalute alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 4, 5, and 6, which show, respectively, several estimated soil properties significant to engineering; interpretations for various engineering uses; and results of engineering laboratory tests on soil samples.

This information, along with the soil map and other parts of this survey, can be used to make interpretations in addition to those given in tables 4, 5, and 6, and it also can be used to make other useful maps.

This information, however, does not eliminate the need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths greater than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have a special meaning to soil scientists that is not known to

[3] By WILLIAM R. EVANS, civil engineer, Soil Conservation Service.

all engineers. The Glossary defines many of these terms commonly used in soil science.

Engineering classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified soil classification system [4], used by the SCS engineers, Department of Defense, and others, and the AASHO system [5], adopted by the American Association of State Highway Officials.

In the Unified soil classification system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identifed as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, ML–CL.

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5 and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHO classification for tested soils, with group index numbers in parentheses, is shown in table 6; the estimated classification, without group index numbers, is given in table 4 for all soils mapped in the survey area.

Engineering properties

Several estimated soil properties significant in engineering are given in table 4. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 4.

Hydrologic soil groups give the runoff potential from rainfall. The soils are classified on the basis of intake of water at the end of long duration storms occurring after prior wetting and opportunity for swelling, and without the protective effects of vegatation.

The four major soil groups are given in the following paragraphs.

Group A consists of soils that have a high infiltration rate even when thoroughly wetted. These soils are chiefly deep, well-drained to excessively drained sands or gravels. They have a high rate of water transmission and a low runoff potential.

Group B consists of soils that have a moderate infiltration rate when thoroughly wetted. These soils are chiefly moderately deep to deep, moderately well drained to well drained soils that have moderately fine texture to moderately coarse texture. They have a moderate rate of water transmission.

Group C consists of soils that have a slow infiltration rate when thoroughly wetted. These soils are chiefly soils that have moderately fine texture to fine texture. They have a slow rate of water transmission.

Group D consists of soils that have a very slow infiltration rate when thoroughly wetted. These soils are chiefly clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. They have a very slow rate of water transmission and a high runoff potential.

Depth to bedrock is the distance from the surface of the soil to the upper surface of the rock layer.

Soil texture is described in table 4 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added; for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary at the back of this soil survey.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 4 do not take into account lateral seepage, or such transient soil features as plowpans and surface crusts.

Available water capacity is the amount of water a soil can hold and make available to plants. It is the numerical difference between the percentage of water at field capacity and the percentage of water at the time plants wilt. The rate is expressed as inches of water per inch of soil depth.

Reaction is the degree of acidity or alkalinity of a soil expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content; that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and

[4] UNITED STATES DEPARTMENT OF DEFENSE. UNIFIED SOIL CLASSIFICATION SYSTEM FOR ROADS, AIRFIELDS, EMBANKMENTS, AND FOUNDATIONS. MIL–STD–619B, 30 pp., illus. 1968.

[5] AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS. STANDARD SPECIFICATIONS FOR HIGHWAY MATERIALS AND METHODS OF SAMPLING AND TESTING. Ed. 8, 2 v., illus. 1961.

TABLE 4.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such to other series that appear in the first column of this table.

Soil series and map symbols	Hydrologic group	Depth to bedrock	Depth from surface	Coarse fraction greater than 3 inches	Dominant USDA texture	Classification	
						Unified	AASHO
		Inches	*Inches*	*Percent*			
Amarillo: AmC	B	>60	0–16		Fine sandy loam	SM–SC, SM	A–4 or A–2–4
			16–52		Sandy clay loam	SC, CL	A–6
			52–80		Sandy clay loam	SC, CL	A–6
Angelo: AnA, AnB, AoA, AoB, AuB.	C	>60	0–12		Clay loam and silty clay	CL	A–6, A–7–6
Urban land part of AuB is too variable to be rated.			12–28		Clay	CL, CH	A–6, A–7–6
			28–58		Silty clay loam	CL	A–6, A–7–6
			58–92		Clay loam	CL	A–6, A–7–6
Berda: BeD	B	>60	0–60		Loam and clay loam	CL	A–4 or A–6
Cobb: CoB	B	20–40	0–8		Fine sandy loam	SM	A–2–4 or A–4
			8–25		Sandy clay loam	SC, CL	A–6
			25–30		Sandy clay loam and sandstone.		
*Cosh: CsD	C	12–20	0–5		Fine sandy loam	SM	A–4 or A–2–4
For Latom part, see Latom series.			5–18		Sandy clay loam	SC or CL	A–6
			18–20		Sandstone.		
*Dev: Dr	A	>60	0–86	0–15	Very gravelly clay loam	GC, GM–GC, SC, SM–SC, GP–GC	A–2
For the Rioconcho part, see Rioconcho series.							
Ector: EcC, EcE	D	4–20	0–8	5–25	Very gravelly clay loam	GC, SC	A–2, A-1
			8–9		Fractured limestone.		
Estacado: EsA, EsB	B	>60	0–44		Loam	CL, ML	A–6
			44–62		Clay loam	CL	A–6
			62–80		Clay loam	CL	A–6
Kavett: KaA, KaB	D	10–20	0–17		Clay	CH, MH–CH	A–7–6
			17–19	0–75	Indurated caliche.		
			19–20		Hard limestone.		
*Kimbrough: KmC, KoD, KuD	D	4–15	0–9	0–10	Gravelly loam	GM, SM	A–4, A–2
For Owens part of KoD, see Owens series. Urban land part of KuD is too variable to be rated.			9–15		Indurated caliche.		
			15–90		Caliche with loam texture.		
Latom	D	4–15	0–12	0–10	Fine sandy loam	SM, SM–SC	A–2–4
Mapped only in a complex with Cosh soils.			12–16		Sandstone.		
Lipan: Lc	D	>60	0–48		Clay	CH	A–7–6
			48–72		Clay	CL, CH	A–7–6
Mereta: MeA, MeB, MuB	C	11–20	0–18		Clay loam	CL	A–6, A–7–6
Urban land part of MuB is too variable to be rated.			18–21		Indurated caliche.		
			21–87		Silty clay loam, clay loam, and caliche.	SC, CL	A–6 or A–7
Olton: OlA, OlB, OuB	C	>60	0–10		Clay loam	CL	A–6
Urban land part of OuB is too variable to be rated.			10–32		Clay	CL	A–6
			32–60		Silty clay loam	CL	A–6, A–4
			60–80		Clay loam	CL	A–6, A–4
Owens	D	12–20	0–16		Clay	CL, CH	A–7–6
Mapped only in a complex with Kimbrough soils.			16–72		Clayey shale	CL, CH	A–6, A–7–6
*Rioconcho: Rn, Rs	C	>60	0–80		Clay loam	CL	A–6 or A–7–6
For Spur part of Rs, see Spur series.							

significant in engineering

mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring
The symbol < means less than; the symbol > means more than]

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to uncoated steel
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					
				Inches per hour	*Inches per inch of soil*	*pH*		
100	100	95–100	35–50	2.00–6.30	0.11–0.15	6.1–8.4	Low	Moderate.
100	95–100	95–100	45–65	0.63–2.00	0.15–0.17	6.1–8.4	Low	Moderate.
90–95	90–95	80–90	45–60	0.63–2.00	0.15–0.17	7.9–8.4	Low	Moderate.
90–100	90–100	85–100	60–90	0.63–2.00	0.10–0.15	7.9–8.4	Moderate	Moderate.
90–100	90–100	85–100	70–93	0.20–0.63	0.10–0.15	7.9–8.4	High	High.
60–100	60–100	60–100	50–90	0.63–2.00	0.10–0.15	7.9–8.4	Moderate	Moderate.
90–100	90–100	75–100	60–90	0.63–2.00	0.10–0.15	7.9–8.4	Moderate	Moderate.
95–100	90–100	80–95	50–65	0.63–2.00	0.14–0.17	7.9–8.4	Low	Moderate.
100	98–100	75–90	30–50	2.00–6.30	0.10–0.14	6.1–8.4	Low	Low.
95–100	90–99	85–98	40–60	0.63–2.00	0.12–0.16	6.6–8.4	Low	Low.
95–100	95–100	70–85	30–45	2.00–6.30	0.10–0.13	6.1–7.3	Low	Low.
90–98	90–98	90–98	40–55	0.63–2.00	0.12–0.15	6.6–7.3	Low	Low.
15–65	10–65	10–45	10–35	2.00–6.30	0.05–0.10	7.9–8.4	Very low	Moderate.
30–70	20–65	15–50	12–35	0.63–2.00	0.05–0.10	7.9–8.4	Very low	High.
95–100	95–100	95–100	51–60	0.63–2.00	0.12–0.16	7.9–8.4	Low	Moderate.
95–100	95–100	85–100	55–80	0.63–2.00	0.12–0.16	7.9–8.4	Low	Moderate.
95–100	95–100	95–100	60–80	0.63–2.00	0.13–0.17	7.9–8.4	Low	Moderate.
90–100	90–100	85–100	80–95	0.20–0.63	0.15–0.20	7.9–8.4	High	High.
55–85	55–85	50–65	30–40	0.63–2.00	0.10–0.15	7.9–8.4	Low	High.
90–100	85–95	80–90	25–35	0.63–2.00	0.10–0.14	7.9–8.4	Very low	Low.
95–100	95–100	95–100	90–95	<0.05	0.15–0.20	7.9–8.4	Very high	High.
95–100	95–100	90–100	80–95	<0.05	0.15–0.20	7.9–8.4	Very high	High.
95–100	85–100	80–93	60–80	0.20–0.63	0.15–0.20	7.9–8.4	Moderate	High.
75–100	65–100	55–90	45–85	0.20–0.63	0.10–0.15	7.9–8.4	Low	High.
100	95–100	85–100	55–75	0.63–0.20	0.15–0.20	6.6–8.4	Low	Moderate.
100	90–100	90–100	65–80	0.20–0.63	0.15–0.20	7.4–8.4	Moderate	High.
90–100	90–100	90–100	60–75	0.20–0.63	0.10–0.15	7.4–8.4	Moderate	Moderate.
90–100	85–100	75–100	60–75	0.20–0.63	0.12–0.15	7.4–8.4	Moderate	Moderate.
95–100	95–100	90–100	80–95	<0.06	0.13–0.17	7.9–8.4	High	High.
90–100	85–100	80–90	55–85	<0.06	0.03–0.08	7.9–8.4	High	High.
95–100	95–100	75–95	70–85	0.06–0.20	0.15–0.20	7.9–8.4	High	High.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Hydrologic group	Depth to bedrock	Depth from surface	Coarse fraction greater than 3 inches	Dominant USDA texture	Classification	
						Unified	AASHO
		Inches	*Inches*	*Percent*			
Rotan: RtA	C	>60	0–8		Clay loam and silty clay loam.	CL	A–6
			8–38		Clay	CL	A–7–6
			38–96		Clay loam	CL	A–6, A–7–6
			96–108		Clay loam	CL	A–6, A–7–6
*Slaughter: ShB, SkA, SuA. For Kimbrough part of SkA, see Kimbrough series. Urban land part of SuA is too variable to be rated.	C	10–20	0–6		Clay loam	CL	A–6
			6–16		Clay	CL, CH	A–6, A–7–6
			16–34		Indurated caliche.		
			34–80		Nodular caliche.		
Spur. Mapped only in an undifferentiated group with Rioconcho soils.	B	>60	0–80		Clay loam	CL, ML–CL	A–6, A–7–6
Tarrant: TaC, TaE	D	6–15	0–10	25–80	Cobbly clay	CH or MH	A–7–5 or A–7–6
			10–12		Hard limestone.		
Tobosa: ToA, ToB	D	>60	0–44		Clay	CH	A–7–6
			44–80		Silty clay	CL, CH	A–7–6, A–6
Tulia: TuA, TuB, TuC, TvC. Urban land part of TvC is too variable to be rated.	B	>60	0–25		Clay loam and loam	CL	A–6 or A–4
			25–80		Silty clay loam	CL, SC	A–6
Urban land: Ur. Too variable to be rated.							

significant in engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to uncoated steel
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					
				Inches per hour	*Inches per inch of soil*	*pH*		
100	100	95-99	75-85	0.63-2.00	0.15-0.19	7.9-8.4	Moderate	High.
95-100	95-100	95-99	75-95	0.20-0.63	0.14-0.18	7.9-8.4	High	High.
95-100	90-100	85-100	70-90	0-20-0.63	0.12-0.15	7.9-8.4	Moderate	High.
95-100	90-100	85-100	70-90	0.20-0.63	0.12-0.15	7.9-8.4	Moderate	High.
100	100	85-95	60-75	0.63-2.00	0.16-0.20	7.9-8.4	Low	Moderate.
95-100	95-100	90-100	65-90	0.20-0.63	0.12-0.17	7.9-8.4	Moderate	High.
100	100	95-100	75-95	0.63-0.20	0.10-0.14	7.9-8.4	Low	Moderate.
80-100	80-100	70-90	70-95	0.20-0.63	0.15-0.17	7.9-8.4	High	High.
98-100	95-100	90-100	75-95	<0.06	0.15-0.20	7.9-8.4	Very high	High.
95-100	90-100	85-100	70-95	<0.06	0.10-0.15	7.9-8.4	High	High.
95-99	90-98	85-95	51-70	0.63-2.00	0.15-0.18	7.9-8.4	Low	Moderate.
95-100	84-100	80-98	45-80	0.63-2.00	0.15-0.18	7.9-8.4	Low	Moderate.

TABLE 5.—*Interpretations of*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such to other series that appear in

Soil series and map symbols	Suitability as source of—		Degree and kind of limitation for—
	Topsoil	Road fill	Local roads and streets
Amarillo: AmC	Fair: fine sandy loam texture.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.
Angelo: AnA, AnB, AuB. Urban land part of AuB is too variable to be rated.	Fair: clay loam texture	Poor: high shrink-swell potential.	Severe: high shrink-swell potential.
AoA, AoB	Poor: silty clay texture	Poor: high shrink-swell potential.	Severe: high shrink-swell potential.
Berda: BeD	Good	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.
Cobb: CoB	Fair: thickness of material	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity; bedrock at a depth of 20 to 40 inches.
*Cosh: CsD. For Latom part, see Latom series.	Poor: thickness of material	Fair: fair traffic-supporting capacity.	Severe: bedrock at a depth of 12 to 20 inches.
*Dev: Dr. For Rioconcho part, see Rioconcho series.	Poor: coarse fragments	Good	Severe: subject to flooding
Ector: EcC, EcE	Poor: coarse fragments	Poor: bedrock at a depth of 4 to 20 inches.	Severe: bedrock at a depth of 4 to 20 inches.
Estacado: EsA, EsB	Good	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.
Kavett: KaA, KaB	Poor: clay texture	Poor: poor traffic-supporting capacity; high shrink-swell potential; bedrock at a depth of 10 to 20 inches.	Severe: bedrock at a depth of 10 to 20 inches; high shrink-swell potential.
*Kimbrough: KmC, KoD, KuD. For Owens part of KoD, see Owens series; Urban land part of KuB is too variable to be rated.	Poor: coarse fragments	Poor: indurated caliche at a depth of 4 to 15 inches.	Severe: indurated caliche at a depth of 4 to 15 inches.
Latom. Mapped only in a complex with Cosh soils.	Fair: thickness of material	Poor: bedrock at a depth of 4 to 15 inches.	Severe: bedrock at a depth of 4 to 15 inches.
Lipan: Lc	Poor: clay texture	Poor: very high shrink-swell potential; poor stability.	Severe: very high shrink-swell potential.
Mereta: MeA, MeB, MuB. Urban land part of MuB is too variable to be rated.	Fair: clay loam texture	Fair: fair traffic-supporting capacity; moderate shrink-swell potential.	Moderate: fair traffic-supporting capacity; moderate shrink-swell potential.
Olton: OlA, OlB, OuB. Urban land part of OuB is too variable to be rated.	Fair: clay loam texture	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.

engineering properties of the soils

mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring the first column of this table]

Degree and kind of limitation for—Continued		Soil features affecting—		
Pond reservoir areas	Pond embankments	Irrigation	Terraces and diversions	Grassed waterways
Moderate: moderate permeability.	Moderate: moderate permeability; hazard of piping; hazard of erosion.	Slope	Susceptible to soil blowing and siltation.	Slope; erodible.
Severe: calcareous substratum.	Moderate: medium compressibility; medium hazard of piping; hazard of erosion.	All features favorable	All features favorable	All features favoarble.
Severe: calcareous substratum.	Moderate: medium compressibility; medium hazard of piping; hazard of erosion.	All features favorable	All features favorable	All features favorable.
Severe: calcareous material.	Moderate: medium compressibility; medium resistance to piping; hazard of erosion.	Sloping topography: limited to sprinkler system.	Erodible: slope	Slope; difficult to vegetate.
Severe: bedrock at a depth of 20 to 40 inches.	Moderate: 20 to 40 inches of borrow material.	Bedrock at a depth of 20 to 40 inches.	Susceptible to soil blowing and siltation.	Erodible; difficult to vegetate.
Severe: bedrock at a depth of 12 to 20 inches.	Severe: 12 to 20 inches of borrow material.	Bedrock at a depth of 12 to 20 inches.	Bedrock at a depth of 12 to 20 inches.	Bedrock at a depth of 12 to 20 inches.
Severe: moderately rapid permeability.	Severe: hazard of piping.	Subject to flooding	Subject to flooding	Subject to flooding.
Severe: bedrock at a depth of 4 to 20 inches.	Severe: 4 to 20 inches of borrow material.	Bedrock at a depth of 4 to 20 inches.	Bedrock at a depth of 4 to 20 inches.	Bedrock at a depth of 4 to 20 inches.
Moderate: moderate permeability.	Moderate: fair stability and resistance to piping.	All features favorable	All features favorable	All features favorable.
Severe: bedrock at a depth of 10 to 20 inches.	Severe: 10 to 20 inches of borrow material.	Bedrock at a depth of 10 to 20 inches; low available water capacity.	Bedrock at a depth of 10 to 20 inches.	Bedrock at a depth of 10 to 20 inches; difficult to vegetate.
Severe: indurated caliche at a depth of 4 to 15 inches.	Severe: 4 to 15 inches of borrow material.	Indurated caliche at a depth of 4 to 15 inches.	Indurated caliche at a depth of 4 to 15 inches.	Indurated caliche at a depth of 4 to 15 inches.
Severe: bedrock at a depth of 4 to 15 inches.	Severe: 4 to 15 inches of borrow material.	Bedrock at a depth of 4 to 15 inches.	Bedrock at a depth of 4 to 15 inches.	Bedrock at a depth of 4 to 15 inches.
Slight	Moderate: very high shrink-swell potential.	May flood; very slow intake rate.	Nearly level	Subject to ponding.
Severe: seepage	Severe: 14 to 20 inches of borrow material.	Low available water capacity; shallow depth affects land leveling.	Indurated caliche at a depth of 14 to 20 inches.	Indurated caliche at a depth of 14 to 20 inches; low available water capacity.
Moderate: moderately slow permeability.	Moderate: fair resistance to piping and erosion.	All features favorable	All features favorable	All features favorable.

TABLE 5.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of—		Degree and kind of limitation for—
	Topsoil	Road fill	Local roads and streets
Owens. Mapped only in a complex with Kimbrough soils.	Poor: clay texture	Poor: high shrink-swell potential.	Severe: high shrink-swell potential.
*Rioconcho: Rn, Rs. For Spur part of Rs, see Spur series.	Fair: clay loam texture	Poor: high shrink-swell potential.	Moderate: subject to flooding.
Rotan: RtA	Fair: clay loam texture	Poor: high shrink-swell potential.	Severe: high shrink-swell potential.
*Slaughter: ShB, SkA, SuA. For Kimbrough part of SkA, see Kimbrough series; Urban land part of SuA is too variable to be rated.	Fair: clay loam texture	Poor: indurated caliche at a depth of 10 to 20 inches.	Severe: indurated caliche at a depth of 10 to 20 inches.
Spur. Mapped only in an undifferentiated group with Rioconcho soils.	Fair: clay loam texture	Fair: fair traffic-supporting capacity.	Moderate: subject to flooding; fair traffic-supporting capacity.
Tarrant: TaC, TaE	Poor: clay mixture	Poor: high shrink-swell potential; bedrock at a depth of 6 to 15 inches.	Severe: bedrock at a depth of 6 to 15 inches.
Tobosa: ToA, ToB	Poor: clay texture	Poor: very high shrink-swell potential; poor traffic-supporting capacity.	Severe: very high shrink-swell potential; poor traffic-supporting capacity.
Tulia: TuA, TuB, TuC, TvC. Urban land part of TvC is too variable to be rated.	Fair: clay loam texture	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.
Urban land: Ur. Too variable to be rated.			

properties of the soils—Continued

Degree and kind of limitation for—Continued		Soil features affecting—		
Pond reservoir areas	Pond embankments	Irrigation	Terraces and diversions	Grassed waterways
Slight	Moderate: fair stability; high compressibility.	Too shallow and too steep.	Too shallow and too steep.	Erodible; vegetation difficult to establish; rapid runoff.
Moderate: seepage	Moderate: medium compressibility; fair resistance to piping and erosion.	Subject to flooding	Subject to flooding	Subject to flooding.
Moderate: moderately slow permeability.	Moderate: fair resistance to piping and erosion.	All features favorable	All features favorable	All features favorable.
Severe: indurated caliche at a depth of 10 to 20 inches.	Severe: 10 to 20 inches inches of borrow material.	Indurated caliche at a depth of 10 to 20 inches.	Indurated caliche at a depth of 10 to 20 inches.	Indurated caliche at a depth of 10 to 20 inches; low available water capacity.
Moderate: moderately permeable.	Moderate: fair resistance to piping and erosion.	Subject to flooding	Subject to flooding	Subject to flooding.
Severe: bedrock at a depth of 6 to 15 inches.	Severe: 6 to 15 inches of borrow material.	Bedrock at a depth of 6 to 15 inches.	Bedrock at a depth of 6 to 15 inches.	Bedrock at a depth of 6 to 15 inches.
Slight	Moderate: fair stability	Very slow intake rate	Cracks where dry	Vegetation difficult to establish.
Moderate: moderately permeable.	Moderate: fair resistance to piping and erosion.	Erodible; slope	Erodible	Erodible.

TABLE 6.—

[Tests performed by the Texas Highway Department in accordance with standard

Soil name and location	Parent material	Texas report No.	Depth from surface	Shrinkage		
				Limit	Lineal	Ratio
			In			
Angelo clay loam:						
3.6 miles E. from the San Angelo courthouse to the intersection of U.S. highway 67 and Loop 306, then 5.2 miles S. on Loop 306; E. side of Loop 306. (Modal.)	Plains outwash.	69–690–R	18–39	14	16.4	1.96
		69–691–R	39–52	20	9.3	1.78
		69–692–R	52–90	15	12.7	1.93
5.0 miles W. from the San Angelo courthouse to the intersection of Ranch Road 853 and Ranch Road 2288, 5.7 miles N. on Ranch Road 2288, then 0.35 mile E. on Grand View 9 Road, and then 175 yards south. (Modal.)	Plains outwash.	69–712–R	20–32	13	13.5	1.92
		69–713–R	32–47	13	13.2	1.96
5.0 miles W. from the San Angelo courthouse to the intersection of Ranch Road 853 and Ranch Road 2288, 4.2 miles N. on Ranch Road 2288, and then 85 yards east. (Modal.)	Plains outwash.	69–707–R	11–27	15	10.8	1.90
		69–708–R	27–40	17	8.5	1.85
Mereta clay loam:						
8.0 miles E. from the San Angelo courthouse on U.S. highway 67 to a private ranch road, 0.9 mile N. on this private road, and then 50 yards east. (Modal.)	Plains outwash.	69–670–R	9–18	16	10.8	1.82
		69–671–R	18–24	17	7.5	1.67
		69–672–R	24–48	8	7.0	1.82
3.0 miles W. from the San Angelo courthouse on U.S. highway 67 to its intersection with Ranch Road 853, 1.2 miles W. on Ranch Road 853, and then 1.2 miles north. (Modal.)	Plains outwash.	69–696–R	6–13	17	12.0	1.81
		69–697–R	13–21	26	4.9	1.59
		69–698–R	21–48	24	5.3	1.66
Olton clay loam:						
5.0 miles W. from the San Angelo courthouse to the intersection of Ranch Road 853 and Ranch Road 2288, 4.0 miles N. to Grand View 7 Road, and 0.7 mile E. on this road, and then 70 yards north. (Modal.)	Plains outwash.	69–688–R	18–35	15	11.1	1.89
		69–689–R	60–78	15	12.4	1.93
5.0 miles W. from the San Angelo courthouse to the intersection of Ranch Road 853 and Ranch Road 2288, 4.0 miles N. to Grand View 7 Road, 0.35 mile on this road, and then 50 yards north. (Modal.)	Plains outwash.	69–702–R	17–26	14	11.2	1.93
		69–703–R	41–68	13	5.6	1.94
		69–704–R	68–74	15	5.2	1.93
Rotan clay loam:						
10 miles N. from the San Angelo courthouse on U.S. highway 87, 2.3 miles W. and S. on Ranch Road 2288, and then 190 yards E. of this road. (Modal.)	Plains outwash.	69–693–R	14–30	15	12.7	1.89
		69–694–R	50–62	15	8.2	1.89
		69–695–R	62–96	14	9.7	1.92
5.0 miles W. from the San Angelo courthouse to the intersection of Ranch Road 853 and Ranch Road 2288, 0.9 mile N. on Ranch Road 2288 to its intersection with a paved road, 1.0 mile E. and N. on the paved road, and then 0.1 mile east. (Modal.)	Plains outwash.	69–699–R	15–26	16	12.3	1.88
		69–700–R	36–72	15	14.8	1.95
		69–701–R	72–84	15	15.0	1.97
Slaughter clay loam:						
E. from the San Angelo courthouse on U.S. highway 67 to North Bell Street, 1.4 miles N. on North Bell Street, and then 100 yards east. (Modal.)	Plains outwash.	69–685–R	9–17	16	15.8	1.90
		69–687–R	25–72	22	5.5	1.68
5.0 miles W. from the San Angelo courthouse to the intersection of Ranch Road 853 and Ranch Road 2288, 3.95 miles N. on Ranch Road 2288, and then 30 yards east. (Modal.)	Plains outwash.	69–705–R	10–20	15	11.7	1.87
		69–706–R	23–40	16	6.8	1.88
Tulia loam:						
10.0 miles N. from the San Angelo courthouse on U.S. highway 87 to its intersection with Ranch Road 2288, 2.15 miles S. on Ranch Road 2288, and then 0.15 mile east. (Modal.)	Plains outwash.	69–682–R	10–32	16	6.9	1.89
		69–683–R	32–48	14	6.5	1.94
		69–684–R	48–72	13	7.8	1.92
5.0 miles W. from the San Angelo courthouse to the intersection of Ranch Road 853 and Ranch Road 2288, 4.75 miles N. on Ranch Road 2288, and then 60 yards east. (Modal.)	Plains outwash.	69–709–R	11–28	16	8.9	1.88
		69–710–R	28–58	18	7.0	1.81
		69–711–R	58–72	14	9.8	1.92

[1] Mechanical analyses according to the AASHO Designation T 88–57 (See footnote 5, page 35). Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil. No materials larger than 3 inches in diameter were included in the samples.

Engineering test data

procedures of the American Association of State Highway Officials (AASHO)]

Mechanical analysis [1]									Percentage smaller than—				Liquid limit	Plasticity index	Classification [2]	
Percentage passing sieve—									0.05 mm	0.02 mm	0.005 mm	0.002 mm			AASHO [3]	Unified [4]
1¾ in	1¼ in	⅞ in	⅝ in	⅜ in	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)								
------	------	------	------	------	100	99	99	93	88	------	61	51	50	26	A-7-6(16)	CL or CH
------	------	------	------	100	97	94	91	86	82	------	63	47	39	21	A-6(12)	CL
------	------	------	100	99	97	94	91	86	81	------	61	46	41	24	A-7-6(14)	CL
------	------	------	------	------	------	100	99	76	67	------	42	36	42	24	A-7-6(14)	CL
------	------	------	------	------	------	100	99	82	73	------	48	41	40	24	A-6(14)	CL
------	------	------	------	------	100	99	97	70	------	------	------	------	37	20	A-6(11)	CL
------	100	94	89	83	77	73	69	52	48	------	32	25	33	18	A-6(6)	CL
------	------	100	99	97	92	87	83	64	------	------	------	------	39	20	A-6(10)	CL
[5] 68	52	45	39	33	26	21	17	12	11	------	6	4	38	16	A-2-6(0)	GW-CC
------	------	100	98	92	78	67	58	45	41	------	24	18	31	15	A-6(4)	SC
------	------	100	99	98	97	95	93	77	------	------	------	------	42	22	A-7-6(13)	CL
[5] 91	78	64	57	48	35	25	16	11	11	------	6	4	36	12	A-2-6(0)	GC
------	------	------	100	96	88	77	68	61	57	------	35	21	34	13	A-6(6)	CL
------	------	------	------	------	------	100	99	71	61	------	36	33	37	20	A-6(11)	CL
------	------	100	99	99	95	88	77	62	58	------	40	30	40	23	A-6(11)	CL
------	------	------	------	------	------	100	99	68	60	------	38	33	36	20	A-6(11)	CL
------	------	------	------	100	99	98	97	63	54	------	31	23	22	10	A-4(6)	CL
------	------	------	------	100	98	98	97	62	52	------	24	18	24	12	A-6(6)	CL
------	------	------	------	------	------	100	99	78	70	------	41	35	41	22	A-7-6(13)	CL
------	------	------	------	100	98	97	97	79	68	------	41	31	30	17	A-6(11)	CL
------	------	100	99	98	96	92	85	72	62	------	31	24	33	20	A-6(12)	CL
------	------	------	------	------	------	------	------	89	76	------	43	37	41	23	A-7-6(13)	CL
------	------	------	------	------	------	100	98	88	77	------	48	40	47	30	A-7-6(17)	CL
------	------	------	------	------	------	100	99	88	79	------	48	41	45	29	A-7-6(17)	CL
------	------	------	------	------	------	100	99	85	75	------	44	35	52	25	A-7-6(16)	CH
100	89	74	66	55	43	33	23	16	15	------	9	6	33	13	A-2-6(0)	GC
------	------	100	99	99	99	98	96	67	------	------	------	------	39	19	A-6(10)	CL
100	92	85	76	65	51	41	33	21	19	------	13	9	28	15	A-2-6(0)	GC
------	------	------	100	99	95	92	90	59	53	------	29	23	26	14	A-6(6)	CL
------	------	100	99	98	97	96	94	62	53	------	29	21	25	14	A-6(7)	CL
------	------	------	------	------	100	99	98	66	56	------	31	24	28	15	A-6(8)	CL
------	------	------	------	100	99	98	95	69	61	------	35	29	34	17	A-6(10)	CL
100	96	96	94	92	88	84	80	65	61	------	42	29	31	15	A-6(8)	CL
100	98	98	97	96	95	93	92	77	70	------	46	32	33	18	A-6(11)	CL

[2] Unified and AASHO classifications made by SCS personnel.
[3] Based on AASHO Designation M 145-49 (See footnote 5, page 35).
[4] Based on the Unified soil classification system (See footnote 4, page 35.
[5] 100 percent passes a 3-inch sieve.

swelling of soils cause much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Corrosivity, as used in table 4, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. Rate of corrosion of uncoated steel is related to soil properties such as drainage, texture, total acidity, and electrical conductivity of the soil material. Corrosivity for concrete is influenced mainly by the content of sodium or magnesium sulfate, but also by soil texture and acidity. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low* means that there is a low probability of soil-induced corrosion damage. A rating of *high* means that there is a high probability of damage, so that protective measures for steel and more resistant concrete should be used to avoid or minimize damage. The corrosivity of concrete is low in all soils in the county, and a column was not included in the table.

Salinity and the depth to seasonal high water table are not problems in any of the soils of the county, and these columns were omitted from table 4.

Engineering interpretations

The interpretations in table 5 are based on the estimates of engineering properties of soils shown in table 4, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Tom Green County.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means soil properties generally are favorable for the rated use or, in other words, that limitations are minor and easily overcome or modified by special planning and design. *Moderate* means that soils have properties favorable for the rated use. Limitations can be overcome or modified with planning, design, or special maintenance. Some of these limitations can be tolerated. *Severe* means soil properties are so unfavorable and so difficult to correct or overcome as to require major soil reclamation, special designs, or intensive maintenance.

Soil suitability is rated by the terms *good, fair,* and poor, which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

Explanations of the columns in table 5 are given in the following paragraphs.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, such as preparing a seedbed; by natural fertility of the material, or the response of plants when fertilizer is applied; and by the absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that will result at the area from which topsoil is taken.

Road fill is soil material used in embankments for roads. The suitability ratings reflect (1) the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage, and (2) the relative ease of excavating the material at borrow areas.

Local roads and streets, as rated in table 5, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Pond embankments are raised structures of soil material constructed across drainageways in order to impound water. These embankments generally are less than 20 feet high and are constructed of homogeneous soil material and compacted to medium density. Embankments that have a core and shell type of construction are not rated in this table. Embankment foundation, reservoir area, and slope are assumed to be suitable for pond construction. Soil properties are considered that affect the embankment and the availability of borrow material. The best soils have good slope stability, low permeability, slight compressibility under load, and good resistance to piping and erosion. The best borrow material is free of stones or rocks and is thick enough for easy excavation.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion, or soil blowing; soil texture; content of stones; accumulations of salts and alkali; depth of the root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and in the fragipan or other layers that restrict movement of water; amount of water held available to plants; and need for drainage, or depth to water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

Grassed waterways are either natural or shaped channels, seeded with grass, to carry runoff water without causing erosion. The suitability of a soil for grassed waterways is determined by the hazard of erosion; the amount of shaping that can be done, which

in turn depends on slope, stoniness, and depth to bedrock; and the difficulty in establishing vegetation.

Engineering test data

Table 6 contains engineering test data for some of the major soil series in Tom Green County. These tests were made to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine the liquid limit and plastic limit. The mechanical analyses were made by combined sieve and hydrometer methods.

Shrinkage limit is the percentage of moisture at which shrinkage of the soil material stops.

Linear shrinkage is the decrease in one dimension, expressed as a percentage of the original dimension, of the soil mass when the moisture content is reduced from the given value to the shrinkage limit.

Shrinkage ratio is the relation of change in volume of the soil material to the water content of the soil material when at the shrinkage limit. The change in volume is expressed as a percentage of the air-dry volume of the soil material, and the water content is expressed as a percentage of the weight of the soil material when ovendry.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from the semisolid to plastic state; and the liquid limit, from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Town and Country Planning

In table 7, the degree and kind of limitations of the soils of Tom Green County for selected nonfarm uses are given. The degree of limitation reflects the features of the given soil, to a depth of about 6 feet, that affect a particular use.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means soil properties generally are favorable for the rated use or, in other words, that limitations are minor and easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means soil properties are so unfavorable and so difficult to correct or overcome as to require major soil reclamation, special designs, or intensive maintenance.

Explanations for the columns in table 7 are given in the following paragraphs.

Dwellings, as rated in table 7, are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the ratings of a soil for dwellings are those that relate to capacity to support load and resist settlement under load, and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Ratings for light industry are for the undisturbed soils that are used to support building foundations. Emphasis is on foundations, ease of excavation for underground utilities, and corrosion potential of uncoated steel pipe. The undisturbed soil is rated for spread footing foundations for buildings less than three stories high on foundation loads not in excess of that weight. Properties affecting load-supporting capacity and settlement under load are wetness, flooding, texture, plasticity, density, and shrink-swell behavior. Properties affecting excavation are wetness, flooding, slope, and depth to bedrock. Properties affecting corrosion of buried uncoated steel pipe are wetness, texture, total acidity, and electrical resistivity.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material from a depth of 18 inches to 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope is a soil property that affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor, and sides, or embankments, of compacted soil material. The assumption is made that the embankment is compacted to medium density and the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, organic matter, and slope; and if the floor needs to be leveled, depth to bedrock is important. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted from the Unified soil classification and the amounts of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated, the ratings in table 7 apply only to a depth of about 6 feet, and therefore limitation ratings of *slight* or *moderate* may not be valid if trenches are to be much deeper than that. For some soils, reliable predictions can be made to a depth of 10 to 15 feet, but re-

TABLE 7.—*Interpretations of the soils*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such to other series that appear in

Soil series and map symbols	Foundations of dwellings	Light industry	Septic tank absorption fields	Sewage lagoons
Amarillo: AmC	Slight	Moderate: moderate corrosivity to uncoated steel.	Slight	Moderate: moderate permeability.
Angelo:				
AnA, AnB, AuB. Urban land part of AuB is too variable to be rated.	Severe: high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: moderately slow permeability.	Severe: calcareous substratum.
AoA, AoB	Severe: high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: moderately slow permeability.	Severe: calcareous substratum.
Berda: BeD	Slight	Moderate: slope	Slight	Severe: seepage
Cobb: CoB	Moderate: bedrock at a depth of 20 to 40 inches.	Slight	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.
*Cosh: CsD. For Latom part, see Latom series.	Severe: bedrock at a depth of 12 to 20 inches.	Severe: bedrock at a depth of 12 to 20 inches.	Severe: bedrock at a depth of 12 to 20 inches.	Severe: bedrock at a depth of 12 to 20 inches.
*Dev: Dr. For Rioconcho part, see Rioconcho series.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding; contamination of water supply.	Severe: moderately rapid permeability; coarse fragments.
Ector: EcC, EcE	Severe: bedrock at a depth of 4 to 20 inches.	Severe: bedrock at a depth of 4 to 20 inches.	Severe: bedrock at a depth of 4 to 20 inches.	Severe: bedrock at a depth of 4 to 20 inches.
Estacado: EsA, EsB	Moderate: low strength.	Moderate: low strength; moderate corrosivity to uncoated steel.	Slight	Moderate: moderately permeable.
Kavett: KaA, KaB	Severe: high shrink-swell potential; bedrock at a depth of 10 to 20 inches.	Severe: high shrink-swell potential; high corrosivity to uncoated steel.	Severe: bedrock at a depth of 10 to 20 inches; moderately slow permeability.	Severe: bedrock at a depth of 10 to 20 inches.
*Kimbrough: KmC, KoD, KuD. For Owens part of KoD, see Owens series; Urban land part of KuD is too variable to be rated.	Severe: indurated caliche at a depth of 4 to 15 inches.	Severe: indurated caliche at a depth of 4 to 15 inches.	Severe: indurated caliche at a depth of 4 to 15 inches.	Severe: indurated caliche at a depth of 4 to 15 inches.
Latom. Mapped only in a complex with Cosh soils.	Severe: bedrock at a depth of 4 to 15 inches.	Severe: bedrock at a depth of 4 to 15 inches.	Severe: bedrock at a depth of 4 to 15 inches.	Severe: bedrock at a depth of 4 to 15 inches.
Lipan: Lc	Severe: very high shrink-swell potential; subject to flooding.	Severe: very high shrink-swell potential; subject to flooding.	Severe: very low permeability.	Severe: subject to flooding.
Mereta: MeA, MeB, MuB. Urban land part of MuB is too variable to be rated.	Moderate: moderate shrink-swell potential.	Moderate: moderate shrink-swell potential; high corrosivity to uncoated steel.	Severe: 14 to 20 inches deep to indurated caliche.	Severe: 14 to 20 inches deep to indurated caliche.
Olton: OlA, OlB, OuB. Urban land part of OuB is too variable to be rated.	Moderate: moderate shrink-swell potential.	Moderate: high corrosivity to uncoated steel.	Moderate: moderately slow permeability.	Moderate: slope

for town and country planning

mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring the first column of this table]

Sanitary landfill	Shallow excavations	Recreation			
		Camp areas	Picnic areas	Playgrounds	Paths and trails
Slight	Slight	Slight	Slight	Moderate: slope	Slight.
Moderate: clay loam texture.	Moderate: clay loam texture.	Moderate: clay loam texture.	Moderate: clay loam texture.	Moderate: clay loam texture.	Moderate: clay loam texture.
Severe: silty clay texture.	Severe: silty clay texture.	Severe: silty clay texture.	Severe: silty clay texture.	Severe: silty clay texture.	Severe: silty clay texture.
Slight	Moderate: clay loam texture.	Slight	Slight	Moderate: slope	Slight.
Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Slight	Slight	Moderate: slope	Slight.
Severe: bedrock at a depth of 12 to 20 inches.	Severe: bedrock at a depth of 12 to 20 inches.	Slight	Slight	Severe: bedrock at a depth of 12 to 20 inches.	Slight.
Severe: subject to flooding; moderately rapid permeability.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding; coarse fragments.
Severe: bedrock at a depth of 4 to 20 inches.	Severe: bedrock at a depth of 4 to 20 inches.	Moderate: coarse fragments.	Moderate: coarse fragments.	Severe: bedrock at a depth of 4 to 20 inches.	Moderate: coarse fragments.
Slight	Slight	Slight	Slight	Slight	Slight.
Severe: bedrock at a depth of 10 to 20 inches.	Severe: bedrock at a depth of 10 to 20 inches.	Severe: clay texture.	Severe: clay texture.	Severe: clay texture.	Severe: clay texture.
Severe: indurated caliche at a depth of 4 to 15 inches.	Severe: indurated caliche at a depth of 4 to 15 inches.	Moderate: coarse fragments.	Moderate: coarse fragments.	Severe: indurated caliche at a depth of 4 to 15 inches; coarse fragments.	Moderate: coarse fragments.
Severe: bedrock at a depth of 4 to 15 inches.	Severe: bedrock at a depth of 4 to 15 inches.	Slight	Slight	Severe: bedrock at a depth of 4 to 15 inches.	Slight.
Severe: subject to flooding; clay texture.	Severe: subject to flooding; clay texture.	Severe: clay texture; very slow permeability.	Severe: clay texture.	Severe: clay texture; very slow permeability.	Severe: clay texture.
Severe: 14 to 20 inches deep to indurated caliche.	Moderate: 14 to 20 inches deep to indurated caliche; (rippable).	Moderate: clay loam texture.	Moderate: clay loam texture.	Severe: 14 to 20 inches deep to indurated caliche.	Moderate: clay loam texture.
Moderate: clay loam texture.	Moderate: clay loam texture.	Moderate: moderately slow permeability.	Moderate: clay loam texture.	Moderate: clay loam texture; moderately slow permeability.	Moderate: clay texture.

TABLE 7.—*Interpretations of the soils*

Soil series and map symbols	Foundations of dwellings	Light industry	Septic tank absorption fields	Sewage lagoons
Owens. Mapped only in a complex with Kimbrough soils.	Severe: high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: very slow permeability.	Moderate: slope.
*Rioconcho: Rn, Rs. For Spur part of Rs, see Spur series.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding; slow permeability.	Severe: flood hazard.
Rotan: RtA	Severe: high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: moderately slow permeability.	Slight.
*Slaughter: ShB, SkA, SuA. For the Kimbrough part of SkA, see Kimbrough series; Urban land part of SuA is too variable to be rated.	Severe: indurated caliche at a depth of 10 to 20 inches.	Severe: indurated caliche at a depth of 10 to 20 inches.	Severe: indurated caliche at a depth of 10 to 20 inches.	Severe: indurated caliche at a depth of 10 to 20 inches.
Spur. Mapped only in an undifferentiated group with Rioconcho soils.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: moderate permeability.
Tarrant: TaC, TaE	Severe: bedrock at a depth of 6 to 15 inches.	Severe: bedrock at a depth of 6 to 15 inches.	Severe: bedrock at a depth of 6 to 15 inches.	Severe: bedrock at a depth of 6 to 15 inches.
Tobosa: ToA, ToB	Severe: very high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: very slow permeability.	Slight.
Tulia: TuA, TuB, TuC, TvC. Urban land part of TvC is too variable to be rated.	Slight.	Moderate: moderate corrosivity to uncoated steel.	Slight.	Moderate: moderate permeability.
Urban land: Ur. Too variable to be rated.				

gardless of that, every site should be investigated before it is selected.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet, as for example, excavations for pipelines, sewerlines, phone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding or a high water table.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehiclular traffic. The best soils have mild slopes, good drainage, a surface free of rocks and coarse fragments, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry.

Picnic areas are attractive natural or landscaped tracts used primarily for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, is confined to access roads. The best soils are firm when wet but not dusty when dry; are free of flooding during the season of use; and do not have slopes or stoniness that greatly increase cost of leveling sites or of building access roads.

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand intensive foot traffic. The best soils have a nearly level surface free of coarse fragments and rock outcrops, good drainage, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry. If grading and leveling are required, depth to rock is important.

Paths and trails are used for local and cross-country travel by foot or horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet but not dusty when dry; are flooded not more than once during the season of use; have slopes of less than 15 percent; and have few or no rocks or stones on the surface.

for town and country planning—Continued

Sanitary landfill	Shallow excavations	Recreation			
		Camp areas	Picnic areas	Playgrounds	Paths and trails
Severe: clay texture.	Severe: clay texture.	Severe: clay texture; very slow permeability.	Severe: clay texture.	Severe: clay texture.	Severe: clay texture.
Severe: subject to flooding.	Severe: subject to flooding.	Moderate: clay loam texture; slow permeability.	Moderate: clay loam texture.	Moderate: clay loam texture; slow permeability.	Moderate: clay loam texture.
Severe: clay texture.	Severe: clay texture.	Moderate: clay loam texture; moderately slow permeability.	Moderate: clay loam texture.	Moderate: clay loam texture; moderately slow permeability.	Moderate: clay loam texture.
Severe: indurated caliche at a depth of 10 to 20 inches.	Severe: indurated caliche at a depth of 10 to 20 inches.	Moderate: clay loam texture.	Moderate: clay loam texture.	Severe: indurated caliche at a depth of 10 to 20 inches.	Moderate: clay loam texture.
Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: clay loam texture; subject to flooding.	Severe: subject to flooding.	Moderate: clay loam texture.
Severe: bedrock at a depth of 6 to 15 inches.	Severe: bedrock at a depth of 6 to 15 inches.	Severe: clay texture.	Severe: clay texture.	Severe: clay texture.	Severe: clay texture.
Severe: clay texture.	Severe: clay texture.	Severe: clay texture; very slow permeability.	Severe: clay texture.	Severe: clay texture; very slow permeability.	Severe: clay texture.
Slight	Slight	Slight	Slight	Moderate: slope	Slight.

Formation and Classification of the Soils

This section discusses the major factors of soil formation as they relate to the soils of Tom Green County. It also explains the system of classification and places each soil in some classes of this system.

Factors of Soil Formation

Soil is a natural, three-dimensional body on the earth's surface that contains living matter and is capable of supporting plants. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, or lay of the land, and (5) the length of time the forces of soil development have acted on the soil material.

Parent material

Parent material is the unconsolidated mass from which a soil forms. It affects the kind of soil that can be formed and, in extreme cases, determines it almost entirely. It also determines the limits of the mineral and chemical composition of the soil.

The parent materials in Tom Green County consist of 48 percent plains outwash or very old alluvium, 44 percent limestone and marl, 6 percent recent alluvium, and 2 percent red marine clay, sandstone, or conglomerate. The soils that formed in outwash are Angelo, Estacado, Kimbrough, Mereta, Olton, Rotan, Slaughter, Tobosa, and Tulia soils. The Kimbrough soils formed in the most calcareous and most gravelly outwash, and Tobosa soils formed in the most clayey outwash. The variations in the Angelo, Estacado, Mereta, Olton, Rotan, Slaughter, and Tulia soils are due to other soil-forming factors.

The soils that formed in materials weathered from limestone are Tarrant, Kavett, and Ector soils. In some places, the hardness of the limestone has affected the soil depth, and in other areas it has affected the slopes. Hard limestone caps have caused steep hills. Softer limestone allows deeper soil development.

Recent alluvium is the parent material of Dev, Rioconcho, and Spur soils. In some places, the alluvium is mostly material weathered from limestone, but in oth-

ers it is a mixture of diverse material. The deep, friable or unconsolidated deposits allow soil development to great depths.

Owens soils formed in red marine clay. The erodibility of the clay has caused these soils to be sloping, and restricted permeability has limited the soil depth.

Cobb and Cosh soils formed in material weathered from sandstone. The quarzitic sand grains in the sandstone resist weathering. The parent material is low in calcium carbonate.

Climate

Climate directly influences the formation of soils through rainfall, evaporation, temperature, and wind. It indirectly affects formation through its influence on the amount and kind of vegetation and animal life. Most of the differences among the soils in this county cannot be attributed to differences in climate alone. The climate in Tom Green County is fairly uniform, but the eastern side of the county probably gets about 3 inches more rain annually than does the extreme western tip. The very shallow soils in the western part of the county are more loamy than the very shallow soils in the eastern part. This difference in texture indicates that there is less weathering of material in the western part.

The annual rainfall in the county is low, and the rate of evaporation is high. As a result of these conditions, there is little leaching of soils, and minerals accumulate in them. About 96 percent of the acreage of the county is soils that are only slightly leached. These soils are calcareous throughout.

Water carries calcium carbonate downward through the soil. The depth at which the calcium carbonate accumulates is influenced by the amount of rainfall and the rate of evaporation, as well as by the amount of water taken in by a soil.

Many of the soils in the county have a weekly visible to distinct zone of calcium carbonate accumulation at the normal wetting depth. In the representative profiles of the soils, this zone is identified by a horizon symbol followed by the symbol *ca*.

The climate of the county apparently is becoming drier. The present wetting depth of soils such as Angelo, Olton, and Rotan ranges from 24 inches to about 60 inches, but these soils show soil development at a depth as great as 96 to 100 inches. The evidence of this earlier and deeper development is a zone of calcium carbonate accumulation, the formation of structure, a redder hue, and a higher chroma at a depth below 60 inches.

Some soils have two separate zones of calcium carbonate accumulation. The more recent and the more distinct zone is at a depth of 24 inches to about 60 inches.

Plant and animal life

Plants, micro-organisms, earthworms, insects, and other animals that live in or on the soil affect soil formation.

Most of the soils in this county formed under grass. The fibrous root system of grasses contributes a large amount of organic matter and helps to keep the soil porous and granular. Decaying grass, leaves, and stems leave organic matter on the surface, and a myriad of micro-organisms decompose the roots and distribute the organic material through the upper layers of the soil.

Insects, worms, and other animals help to supply minerals by bringing parent material to the surface. They also mix and loosen soil material.

At one time prairie dogs were abundant and widely distributed throughout this area (fig. 15). Prairie dog burrows on the outwash plains east of San Angelo extended down 10 to 12 feet. A few burrows reached a depth of 15 feet. After hundreds of years and many generations of prairie dogs, the mounds coalesced, and several inches of highly calcareous parent material was left on the surface.

Man, too, affects soil formation in various ways, and some of his activities drastically change the soil. Plowing, for example, mixes the upper layers, hastens the decay of organic matter, lightens the color, and exposes the surface to soil blowing and water erosion. Construction activities also alter or destroy the soil. Some soils are excavated, buried, or mixed with worthless material. Some soils are leveled and made deeper and subsequently have slower runoff.

Relief

Relief influences soil development through its effect on drainage and runoff. If other factors of soil development are equal, the degree to which horizons develop in a soil depends on the amount of water that enters it. Nearly level or depressional soils, for example, have the deepest development, and the formation of horizons in steep soils is retarded by runoff and continuous erosion.

The deepest soils in the county are the depressional Lipan and Rotan soils; the nearly level Angelo and Olton soils are of intermediate depth; and the sloping Mereta soils are an example of shallow soil development. The least developed soils are the more sloping Owens, Kimbrough, Tarrant, and Ector soils.

About one-third of the soils of the county are nearly level soils that formed in alluvium. These soils are on the outwash plain east of San Angelo and the flood plains along the streams. Deep soil development has occurred here despite the low rainfall. About one-half the soils of the county are very shallow because of the steepness of the slope.

Time

A great length of time is required for the soil-forming factors of climate, relief, and living organisms to influence soil characteristics.

Many of the soils in this county are young; that is, the processes of soil formation have not been completed. Some parent material that has been in place for only a short time has undergone only minor changes. Few changes have occurred in the Berda, Spur, Dev, and Rioconcho soils.

Some older soils are calcareous and have a noticeable accumulation of calcium carbonate or have a calcic horizon at some level in the profile. Aging leaches the calcium carbonate downward from the upper horizons

Figure 15.—**Prairie dog town on a Tulia loam. About 5 percent of the area is mounds that contain 5 to 10 cubic feet of highly calcareous soil material.**

to lower horizons, or, with age, the calcium carbonate is concentrated in one area where it becomes cemented or indurated. Indurated or petrocalcic horizons require a great length of time for development. Petrocalcic horizons are identified in soil descriptions by the horizon symbol followed by the symbol *cam*. The Kimbrough, Slaughter, and Mereta soils have petrocalcic horizons.

Another stage of development that requires a considerable length of time is the downward movement of clay. Clay does not move downward until after the soil has been leached of calcium carbonate. Then the surface layer loses clay and the lower horizons gain it. The horizon that gains clay is the argillic horizon. In soil descriptions, it is identified by the symbol *t* following the horizon symbol. In Tom Green County, Amarillo, Cobb, Cosh, Olton, Rotan, and Slaughter soils have an argillic horizon.

In some soils, time is relatively unimportant because one or more of the other soil-forming factors dominate. The Kimbrough soils, for example, have been in place a great length of time, as evidenced by their petrocalcic horizon. They are shallow soils, however, because the relief allows a considerable amount of erosion. Time also has had little influence on depth and horizonation in the Owens soils. The parent material is erodible clay that is nearly impervious to water.

The factor of time is offset in soils such as the Angelo Soils, where new parent material is brought to the surface by prairie dogs and other animal life. In the places where new material is introduced, soil development must start again.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas such as countries and continents.

The system of soil classification used was adopted by the National Cooperative Soil Survey in 1965.[6] Because this system is under continual study, readers in-

[6] SIMONSON, ROY W. SOIL CLASSIFICATION IN THE UNITED STATES. Sci. 137, No. 3535, 1027-1034. 1962.

terested in developments of the system should search the latest literature available.[7]

The system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. In table 8, the soil series of Tom Green County are placed in the categories of the classification system. Classes of this system are briefly defined in the following paragraphs.

ORDER: Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates. Each order is named with a word of three or four syllables ending in *sol.*

SUBORDER: Each order is subdivided into suborders that are based primarily on those soil charcteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order.

GREAT GROUP: Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder.

SUBGROUP: Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group.

FAMILY: Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reactions, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used as family differentiae (see table 8).

[7] UNITED STATES DEPARTMENT OF AGRICULTURE. SOIL CLASSIFICATION, A COMPREHENSIVE SYSTEM, 7TH APPROXIMATION. 265 pp, illus. [Supplements issued in March 1967 and September 1968]. 1960.

General Nature of the County

In this section, the geology, climate, and water supply of Tom Green County are discussed.

TABLE 8.—*Classification of soil series*

Series	Family	Subgroup	Order
Amarillo	Fine-loamy, mixed, thermic	Aridic Paleustalfs	Alfisols.
Angelo	Fine, mixed, thermic	Torrertic Calciustolls	Mollisols.
Berda	Fine-loamy, mixed, thermic	Aridic Ustochrepts	Inceptisols.
Cobb	Fine-loamy, mixed, thermic	Udic Haplustalfs	Alfisols.
Cosh	Loamy, mixed, thermic, shallow	Udic Rhodustalfs	Alfisols.
Dev	Loamy-skeletal, carbonatic, thermic	Cumulic Haplustolls	Mollisols.
Ector	Loamy-skeletal, carbonatic, thermic	Lithic Calciustolls	Mollisols.
Estacado	Fine-loamy, mixed, thermic	Calciorthidic Paleustolls	Mollisols.
Kavett	Clayey, montmorillonitic, thermic, shallow	Petrocalcic Calciustolls	Mollisols.
Kimbrough	Loamy, mixed, thermic, shallow	Petrocalcic Calciustolls	Mollisols.
Latom	Loamy, mixed (calcareous), thermic	Lithic Ustic Torriorthents	Entisols.
Lipan	Fine, montmorillonitic, thermic	Entic Pellusterts	Vertisols.
Mereta	Clayey, mixed, thermic, shallow	Petrocalcic Calciustolls	Mollisols.
Olton	Fine, mixed, thermic	Aridic Paleustolls	Mollisols.
Owens	Clayey, mixed, thermic, shallow	Typic Ustochrepts	Inceptisols.
Rioconcho	Fine, mixed, thermic	Vertic Haplustolls	Mollisols.
Rotan	Fine, mixed, thermic	Pachic Paleustolls	Mollisols.
Slaughter	Clayey, mixed, thermic, shallow	Petrocalcic Paleustolls	Mollisols.
Spur	Fine-loamy, mixed, thermic	Fluventic Haplustolls	Mollisols.
Tarrant	Clayey-skeletal, montmorillonitic, thermic	Lithic Calciustolls	Mollisols.
Tobosa	Fine, montmorillonitic, thermic	Typic Chromusterts	Vertisols.
Tulia	Fine-loamy, carbonatic, thermic	Calciorthidic Paleustalfs	Alfisols.

Geology

Material from the Permian, Cretaceous, and Quaternary Periods makes up the parent material of the soils in this county. Soils that are associated in a general way formed in material from similar geologic times.

Material from the Permian Period influenced the formation of the Olton, Cobb, Owens, and Cosh soils, among others. This material is red clay and red and yellow sandstone. The Owens soils, for example, formed in red clay, and the Cobb and Cosh soils formed in material weathered from sandstone. Permian material that has been eroded contributed to the parent material of several other soils.

Material from the Cretaceous Period influenced the formation of Tarrant, Ector, Rioconcho, and Spur soils. The parent material of the Tarrant and Ector soils is hard limestone and a small amount of marl. Material that eroded from limestone contributed to the formation of the alluvial Rioconcho and Spur soils.

Material from the Quaternary Period influenced the formation of the Kimbrough, Mereta, and Angelo soils. This material was deposited by water after streams had eroded through the material from the Cretaceous Period and into the Permian material. The Quaternary material generally is deposited on top of Permian material. The Quaternary material ranges from a few feet to 35 feet or more in thickness. In some places, deposits of Quaternary material have been removed by erosion. This kind of erosion occurred in areas where the Olton, Cobb, and Cosh soils formed. There are deposits of Quaternary material on a few knolls and low hills in these areas. An example of soils that formed in areas where Permian and Quaternary materials are closely related is the Kimbrough-Owens complex. The Kimbrough soils formed in Quaternary material, and the Owens soils formed in Permian material. Quaternary deposits also contributed to the alluvium in which the Rioconcho and Spur soils formed.

Climate [8]

The climate of Tom Green County is generally classified as semiarid, or "steppe," but some of its characteristics are similar to those of a humid temperate climate. The weather is dominantly warm and dry, but the passage of cold fronts, or "northers," may cause rapid and frequent changes. Abrupt, large drops in temperature are common, especially in winter. Temperature and precipitation data are given in table 9.

The average number of days between the last freezing temperature in spring and the first freezing temperature in fall is 232 days. The average dates of these occurrences are March 24 and November 13, respectively. Freezing temperatures have occurred as late as April 18 and as early as October 16.

Most precipitation is in the form of convective showers and thunderstorms that have considerable variation in both the amount of water received and in the geographic areas affected. During 1936 the total precipitation was 40.40 inches, 27.65 inches of which fell in September as a result of the inland passage of a tropical storm from southern Texas. Much more precipitation occurred in this one month than commonly occurs in a year. Heavy precipitation during a given year generally is caused by the movement of a tropical hurricane inland, over the San Angelo area, from southern Texas. The driest year of record was 1956, when only 7.41 inches of rain fell. Of that amount 2.14 inches fell in the month of October. During a period of half a century, there have been 30 months with no measurable precipitation at all.

Snowfall averages 2.5 inches a year, but the snowfall seldom remains on the ground for longer than a few hours at a time, a day or two at the longest. The maximum monthly amount of 13.0 inches of snow fell in February 1924 and January 1926, but 22 years out of the past half century have had no snow or only a trace.

Relative humidity averages 73 percent in the early morning hours and 40 percent late in the afternoon. The greatest variation in humidity occurs in the summer months, when it ranges from 77 and 78 percent early in the morning to the lower thirties early in the evening. This wide variation, coupled with an annual average wind velocity of 11 miles per hour, helps to moderate what would otherwise be an extremely uncomfortable climatic characteristic. The humidity is higher than that of a true semiarid climate. It is this factor that places this area very nearly in the humid temperate category, even though precipitation amounts are in the range of a typical semiarid climate.

Water Supply

The amount of ground water of acceptable quality generally is adequate for homes, livestock, and gardens. There is, however, little ground water for irrigation or municipal use. There are no major underground reservoirs in the county, and a small area southwest of San Angelo has no suitable underground water for use in the home or for livestock.

Many of the springs in the county have dried up, and streams, such as the North Concho River, Middle Concho River, and Grape Creek, which formerly were perennial streams, have been dry for many years and flow only after rains.

The reasons the water table is low are, principally, the tremendous increase of mesquite trees on the watersheds and, to a lesser extent, the withdrawal of water for irrigation. If the abundant mesquite on the Angelo, Rioconcho, Spur, and Dev soils were removed, the water yield could be increased. For example, Rocky Creek, a small tributary of the North Concho River, has recently been restored to perennial flow by replacing 70 percent of the mesquite on the watershed with grass.

There are three water storage reservoirs in the county: Lake Nasworthy, which has a storage capacity of 12,390 acre-feet; San Angelo Reservoir, which has a capacity of 119,180 acre-feet; and Twin Buttes Reservoir, which has a capacity of 177,500 acre-feet.

[8] By ROBERT B. ORTON, climatologist for Texas, National Weather Service, U.S. Department of Commerce.

TABLE 9.—*Temperature*

[All data from San Angelo; elevation 1,903 feet; based on data

Month	Temperature				Precipitation				
	Average daily maximum [1]	Average maximum [2]	Average daily minimum [1]	Average minimum [2]	Average total [1]	Probability of receiving— 0 or trace	0.5 in or more	1.00 in or more	2.00 in or more
	°F	*°F*	*°F*	*°F*	*In*	*Pct*	*Pct*	*Pct*	*Pct*
January	59.4	79.4	34.3	14.2	0.97	2	60	38	10
February	62.7	82.6	38.3	19.6	.90	5	60	37	10
March	70.2	87.4	43.7	24.2	.93	1	50	30	8
April	80.6	93.9	53.6	36.0	2.01	<1	85	70	40
May	86.5	99.5	62.1	46.3	3.20	<1	95	90	60
June	94.4	102.2	70.5	59.1	1.82	1	75	60	37
July	96.9	102.9	72.7	64.3	1.41	7	70	53	30
August	97.5	103.7	72.6	62.6	1.27	5	70	50	28
September	90.4	99.1	66.1	51.1	2.66	5	80	67	43
October	81.3	92.2	55.3	37.6	1.83	5	80	80	38
November	67.6	84.5	41.9	25.7	.78	9	60	35	13
December	60.2	78.3	35.2	19.7	.85	5	60	40	12
Year	79.0		53.9		18.63				

[1] Period of record, 1931–1960.
[2] Period of record, 1941–1970.

In spite of its three large reservoirs, the city of San Angelo has suffered a water shortage, and efforts are being made to develop a reliable supply. In 1971 the San Angelo Reservoir was dry and the Twin Buttes Reservoir was very low.

In the 1950's the irrigated cropland in the county was about 10,000 acres, in the mid-1960's it was about 17,000 acres, and presently it is 13,800 acres. East of San Angelo, there are about 1,200 acres irrigated from wells; about 2,800 acres is irrigated from wells in the North Concho River Valley; and 900 acres in the rest of the county. Acreages irrigated with surface water are mostly along the South Concho River, Dove Creek, and Spring Creek. If irrigation water were available from a source outside the county, there would be a larger area of irrigated cropland. An additional 10,000 acres of cropland would be irrigated if water were available from the Twin Buttes Reservoir, for example.

The total acreage of cropland in the county has increased gradually in recent years. This increase is a result of the conversion of rangeland to cropland. There has been a small loss in the total area of land used for farming as a result of the expansion of the city of San Angelo and of the construction of highways.

Glossary

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Caliche. A more or less cemented deposit of calcium carbonate in many soils of warm-temperate areas, as in the Southwestern States. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the solum, or it may be exposed at the surface by erosion.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artifi-

and precipitation

for the period 1931–1970. The symbol < means less than]

Precipitation—Continued									
Probability of receiving—Continued				Average number of days with—[3]			Snow, sleet		
3.00 in or more	4.00 in or more	5.00 in or more	6.00 in or more	0.10 in or more	0.5 in or more	1 in or more	Annual total [4]	Greatest monthly [4]	Greatest depth [3]
Pct	*Pct*	*Pct*	*Pct*						
5	1	<1	<1	2	([5])	([5])	0.9	7.0	3
4	1	<1	<1	2	([5])	([5])	.9	4.7	4
4	1	<1	<1	2	([5])	([5])	.3	3.1	2
20	10	4	1	3	1	([5])	0	0	0
40	30	18	5	4	2	1	0	0	0
20	10	8	5	3	1	1	0	0	0
19	10	7	4	2	1	([5])	0	0	0
10	6	4	2	2	1	([5])	0	0	0
33	21	20	10	4	2	1	0	0	0
24	14	8	5	3	1	([5])	0	0	0
6	2	1	<1	3	1	([5])	.7	8.8	4
5	2	1	<1	2	([5])	0	.2	1.9	2
----------	----------	----------	----------	32	10	3	3.0	8.8	4

[3] Period of record, 1956–1970.
[4] Period of record, 1948–1970.
[5] Less than one-half day.

cial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Gilgai. Typically, the microrelief of Vertisols—clayey soils that have a high coefficient of expansion and contraction with changes in moisture; usually a succession of microbasins and microknolls, in nearly level areas, or of microvalleys and microridges that run with the slope.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, and it may be cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to relatively level plots surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops, or in orchards, to confine the flow of water to one direction.

Furrow.—Water is applied in small ditches made by cultivation implements used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Irrigation water, released at high points, flows onto the field without controlled distribution.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Phase, soil. A subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil type, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is preisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth referes to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series to which the mapping unit belongs. In referring to a capability unit or wildlife group, read the introduction to the section it is in for general information about its management. Other information is given in tables as follows:

Acreage and extent, table 1, page 5.
Predicted yields, table 2, page 28.
Suitability of soils for wildlife, table 3, page 33.
Engineering uses of the soils, tables 4, 5, and 6, pages 36 through 45.
Interpretations of soils for town and country planning, table 7, page 48.

Map symbol	Mapping unit	Page	Capability unit: Dryland Symbol	Capability unit: Irrigated Symbol	Range site Name
AmC	Amarillo fine sandy loam, 3 to 5 percent slopes-------	5	IVe-2	IIIe-1	Sandy Loam
AnA	Angelo clay loam, 0 to 1 percent slopes---------------	6	IIIc-1	I-1	Clay Loam
AnB	Angelo clay loam, 1 to 3 percent slopes---------------	7	IIIe-1	IIe-1	Clay Loam
AoA	Angelo silty clay, 0 to 1 percent slopes--------------	7	IIIc-1	I-1	Clay Loam
AoB	Angelo silty clay, 1 to 3 percent slopes--------------	7	IIIe-1	IIe-1	Clay Loam
AuB	Angelo-Urban land complex, 0 to 3 percent slopes------	7	-----	-----	--------
BeD	Berda loam, 3 to 8 percent slopes---------------------	8	IVe-2	-----	Hardland Slopes
CoB	Cobb fine sandy loam, 1 to 3 percent slopes-----------	8	IIIe-2	IIe-2	Sandy Loam
CsD	Cosh-Latom complex, 1 to 8 percent slopes-------------	9	VIe-1	-----	Sandstone Hill
Dr	Dev and Rioconcho soils-------------------------------	10	VIw-1	-----	Bottom Land
EcC	Ector association, undulating-------------------------	10	VIIs-2	-----	Shallow Hills
EcE	Ector association, hilly------------------------------	10	VIIs-2	-----	Shallow Hills
EsA	Estacado loam, 0 to 1 percent slopes------------------	11	IIIe-3	-----	Hardland Slopes
EsB	Estacado loam, 1 to 3 percent slopes------------------	11	IIIe-2	-----	Hardland Slopes
KaA	Kavett clay, 0 to 1 percent slopes--------------------	12	IIIs-1	IIs-2	Shallow
KaB	Kavett clay, 1 to 3 percent slopes--------------------	12	IIIe-4	IIIe-2	Shallow
KmC	Kimbrough association, undulating---------------------	13	VIIs-1	-----	Very Shallow
KoD	Kimbrough-Owens complex, 1 to 8 percent slopes--------	13	VIIs-1	-----	--------
	Kimbrough part--	--	-----	-----	Very Shallow
	Owens part--	--	-----	-----	Shallow Clay
KuD	Kimbrough-Urban land complex, 1 to 8 percent slopes---	13	-----	-----	--------
Lc	Lipan clay--	15	IIIw-1	IIs-1	Lakebed
MeA	Mereta clay loam, 0 to 1 percent slopes---------------	15	IIIs-3	IIIs-1	Shallow
MeB	Mereta clay loam, 1 to 3 percent slopes---------------	16	IIIe-4	IIIe-2	Shallow
MuB	Mereta-Urban land complex, 0 to 3 percent slopes------	16	-----	-----	--------
OlA	Olton clay loam, 0 to 1 percent slopes----------------	17	IIIe-3	I-1	Clay Loam
OlB	Olton clay loam, 1 to 3 percent slopes----------------	17	IIIe-1	IIe-1	Clay Loam
OuB	Olton-Urban land complex, 0 to 3 percent slopes-------	17	-----	-----	--------
Rn	Rioconcho clay loam-----------------------------------	18	IIc-1	I-3	Bottom Land
Rs	Rioconcho and Spur soils------------------------------	19	IIc-1	I-3	Bottom Land
RtA	Rotan clay loam, 0 to 1 percent slopes----------------	19	IIc-2	I-1	Clay Loam
ShB	Slaughter clay loam, 1 to 3 percent slopes------------	21	IVe-1	IIIe-2	Shallow
SkA	Slaughter-Kimbrough complex, 0 to 1 percent slopes----	21	IVe-1	-----	--------
	Slaughter part--	--	-----	-----	Shallow
	Kimbrough part--	--	-----	-----	Very Shallow
SuA	Slaughter-Urban land complex, 0 to 1 percent slopes---	21	-----	-----	--------
TaC	Tarrant association, undulating-----------------------	22	VIIs-2	-----	Low Stony Hill
TaE	Tarrant association, hilly----------------------------	22	VIIs-2	-----	Low Stony Hill
ToA	Tobosa clay, 0 to 1 percent slopes--------------------	23	IIIs-2	IIs-1	Heavy Clay
ToB	Tobosa clay, 1 to 3 percent slopes--------------------	24	IIIe-1	IIe-1	Heavy Clay
TuA	Tulia loam, 0 to 1 percent slopes---------------------	24	IIIe-3	I-2	Hardland Slopes
TuB	Tulia loam, 1 to 3 percent slopes---------------------	25	IIIe-2	IIe-1	Hardland Slopes
TuC	Tulia loam, 3 to 5 percent slopes---------------------	25	IVe-2	-----	Hardland Slopes
TvC	Tulia-Urban land complex, 0 to 5 percent slopes-------	25	-----	-----	--------
Ur	Urban land--	26	-----	-----	--------

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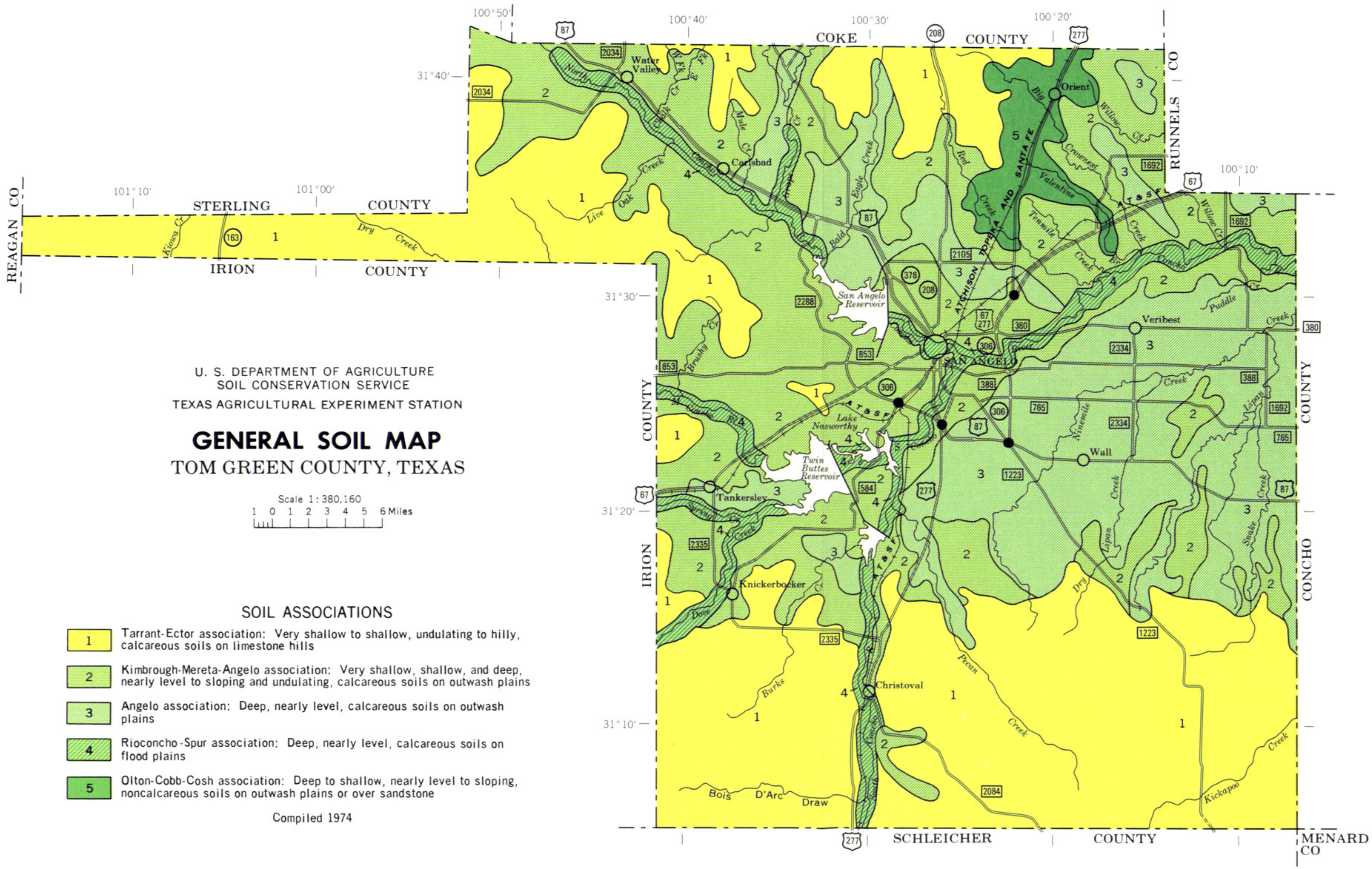
GENERAL SOIL MAP
TOM GREEN COUNTY, TEXAS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION



Scale 1:380,160

1 0 1 2 3 4 5 6 Miles

SOIL ASSOCIATIONS

1 Tarrant-Ector association: Very shallow to shallow, undulating to hilly, calcareous soils on limestone hills

2 Kimbrough-Mereta-Angelo association: Very shallow, shallow, and deep, nearly level to sloping and undulating, calcareous soils on outwash plains

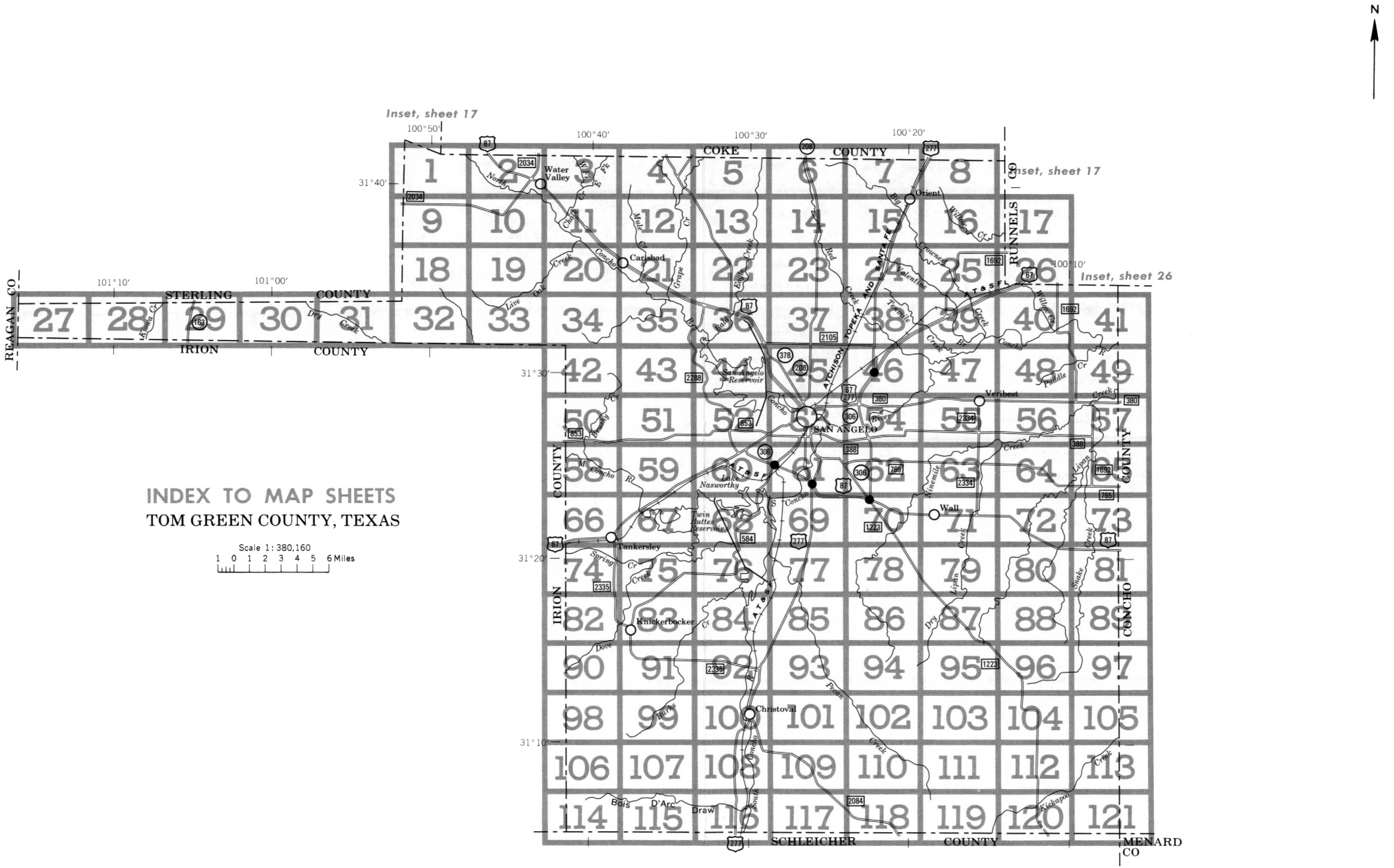
3 Angelo association: Deep, nearly level, calcareous soils on outwash plains

4 Rioconcho-Spur association: Deep, nearly level, calcareous soils on flood plains

5 Olton-Cobb-Cosh association: Deep to shallow, nearly level to sloping, noncalcareous soils on outwash plains or over sandstone

Compiled 1974

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



INDEX TO MAP SHEETS

TOM GREEN COUNTY, TEXAS

Scale 1:380,160

1 0 1 2 3 4 5 6 Miles

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Gravel pit (G.P.)

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canal or ditch, single-line irrigation

Lakes and ponds
- Perennial (water) (w)
- Intermittent (int)

Spring

Marsh or swamp

Maximum flood pool line

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

Prominent peak

Depressions (Large / Small)
- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land (M.L.)
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Caliche pit (C.P.)
- Sanitary land fill (S.L.F.)
- Excavated area (E.A.)
- Sand and gravel pit (S.G.P.)

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, or E, indicates the class of slope. Most symbols without a slope letter are those of nearly level soils, but some are for soils and land types that have a considerable range of slope.

SYMBOL	NAME
AmC	Amarillo fine sandy loam, 3 to 5 percent slopes
AnA	Angelo clay loam, 0 to 1 percent slopes
AnB	Angelo clay loam, 1 to 3 percent slopes
AoA	Angelo silty clay, 0 to 1 percent slopes
AoB	Angelo silty clay, 1 to 3 percent slopes
AuB	Angelo-Urban land complex, 0 to 3 percent slopes
BeD	Berda loam, 3 to 8 percent slopes
CoB	Cobb fine sandy loam, 1 to 3 percent slopes
CsD	Cosh-Latom complex, 1 to 8 percent slopes
Dr	Dev and Rioconcho soils
EcC	Ector association, undulating *
EcE	Ector association, hilly *
EsA	Estacado loam, 0 to 1 percent slopes
EsB	Estacado loam, 1 to 3 percent slopes
KaA	Kavett clay, 0 to 1 percent slopes
KaB	Kavett clay, 1 to 3 percent slopes
KmC	Kimbrough association, undulating *
KoD	Kimbrough-Owens complex, 1 to 8 percent slopes
KuD	Kimbrough-Urban land complex, 1 to 8 percent slopes
Lc	Lipan clay
MeA	Mereta clay loam, 0 to 1 percent slopes
MeB	Mereta clay loam, 1 to 3 percent slopes
MuB	Mereta-Urban land complex, 0 to 3 percent slopes
OlA	Olton clay loam, 0 to 1 percent slopes
OlB	Olton clay loam, 1 to 3 percent slopes
OuB	Olton-Urban land complex, 0 to 3 percent slopes
Rn	Rioconcho clay loam
Rs	Rioconcho and Spur soils
RtA	Rotan clay loam, 0 to 1 percent slopes
ShB	Slaughter clay loam, 1 to 3 percent slopes
SkA	Slaughter-Kimbrough complex, 0 to 1 percent slopes
SuA	Slaughter-Urban land complex, 0 to 1 percent slopes
TaC	Tarrant association, undulating *
TaE	Tarrant association, hilly *
ToA	Tobosa clay, 0 to 1 percent slopes
ToB	Tobosa clay, 1 to 3 percent slopes
TuA	Tulia loam, 0 to 1 percent slopes
TuB	Tulia loam, 1 to 3 percent slopes
TuC	Tulia loam, 3 to 5 percent slopes
TvC	Tulia-Urban land complex, 0 to 5 percent slopes
Ur	Urban land

* The delineations generally are much larger and the composition of these units is more variable than other map units in the county. Mapping has been controlled well enough, however, for the anticipated use of the soils.

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

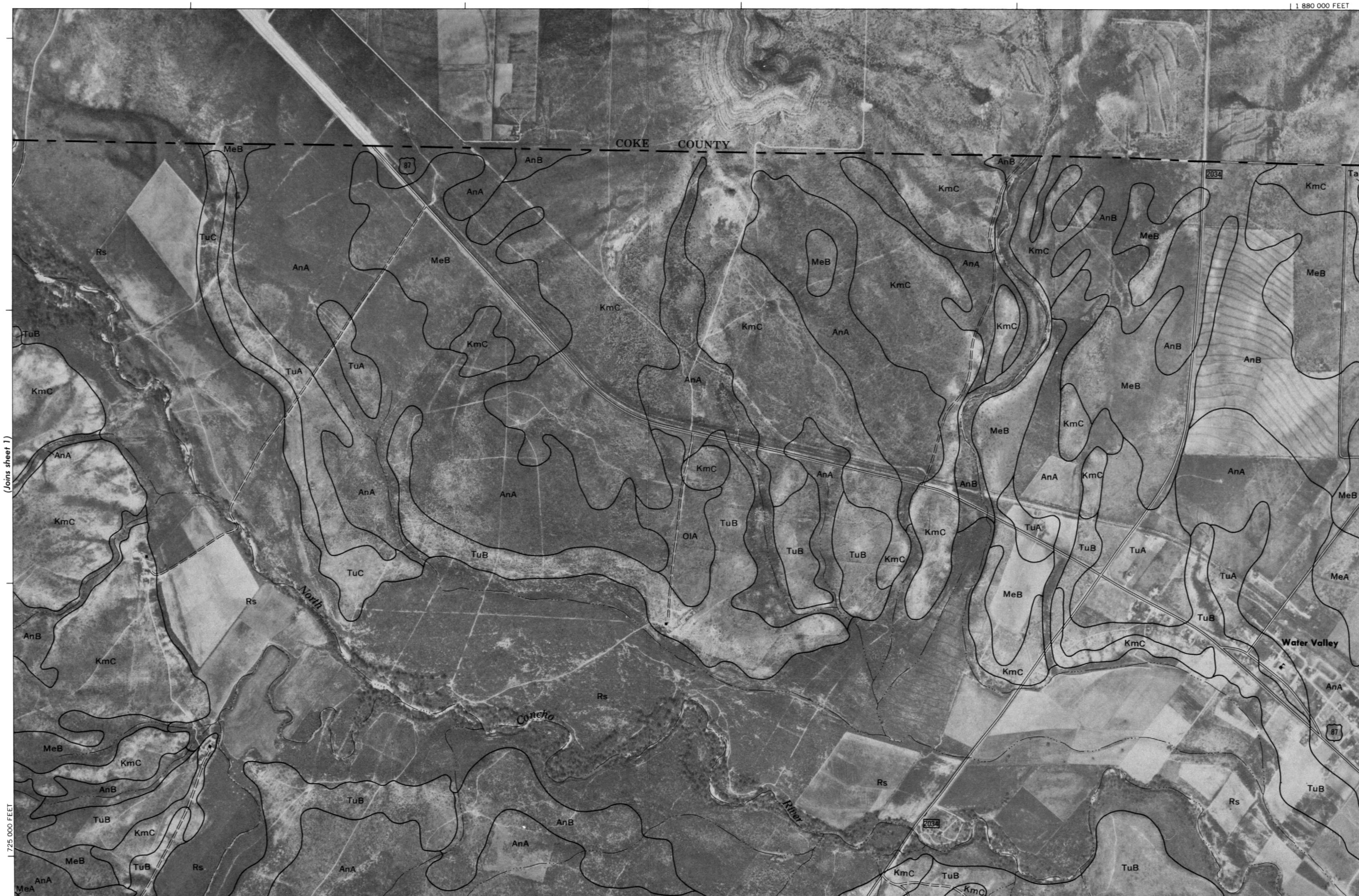
TOM GREEN COUNTY, TEXAS — SHEET NUMBER 2

N

1 Mile · 5000 Feet

Scale 1:20 000

0 · 0 · 1000 · ¼ · 2000 · ½ · 3000 · ¾ · 4000 · 5000 · 1



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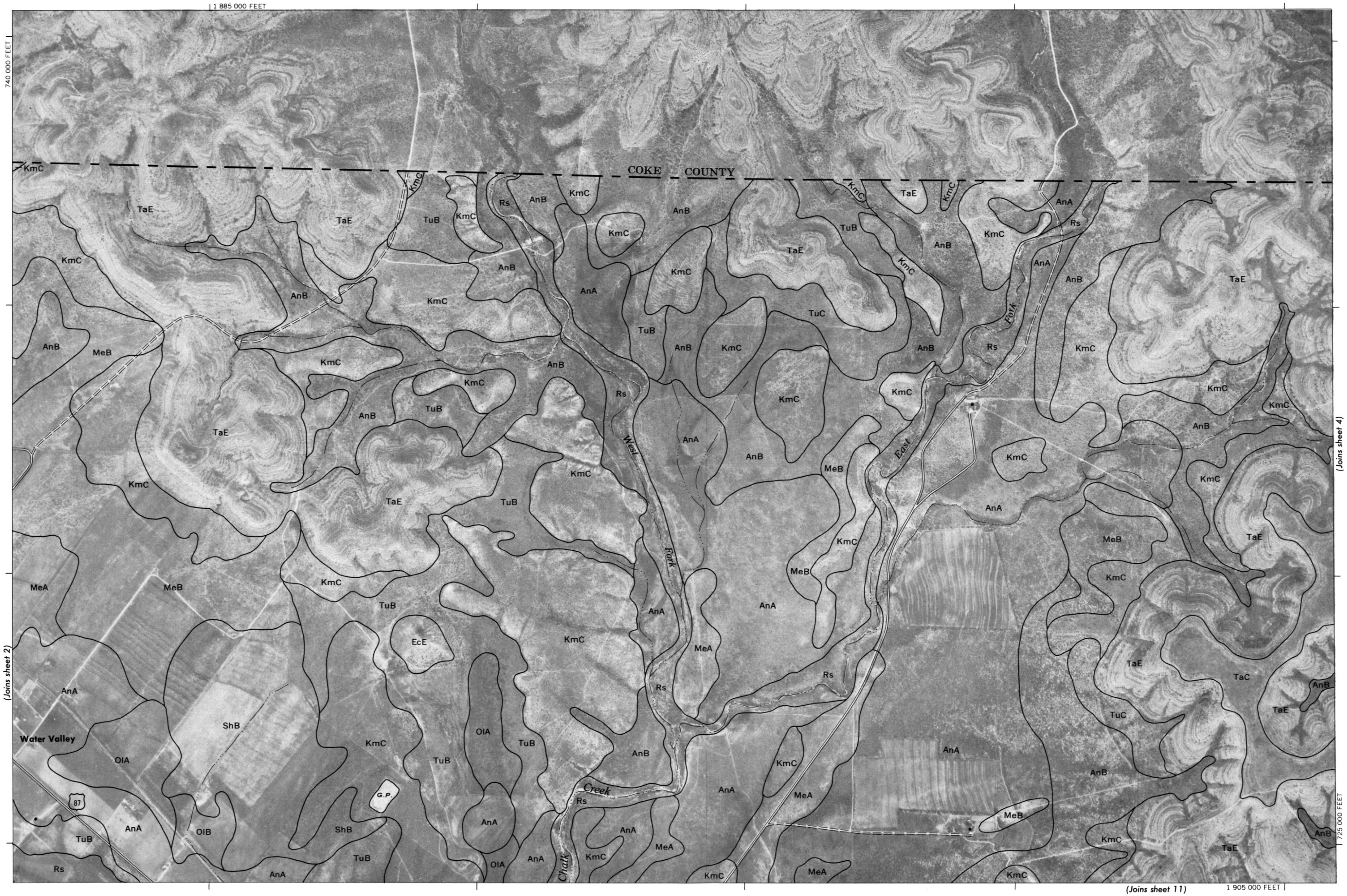

N

Scale 1:20000

0 ¼ ½ ¾ 1 Mile

0 1000 2000 3000 4000 5000 Feet

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N

1 Mile 5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

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TOM GREEN COUNTY, TEXAS — SHEET NUMBER 6

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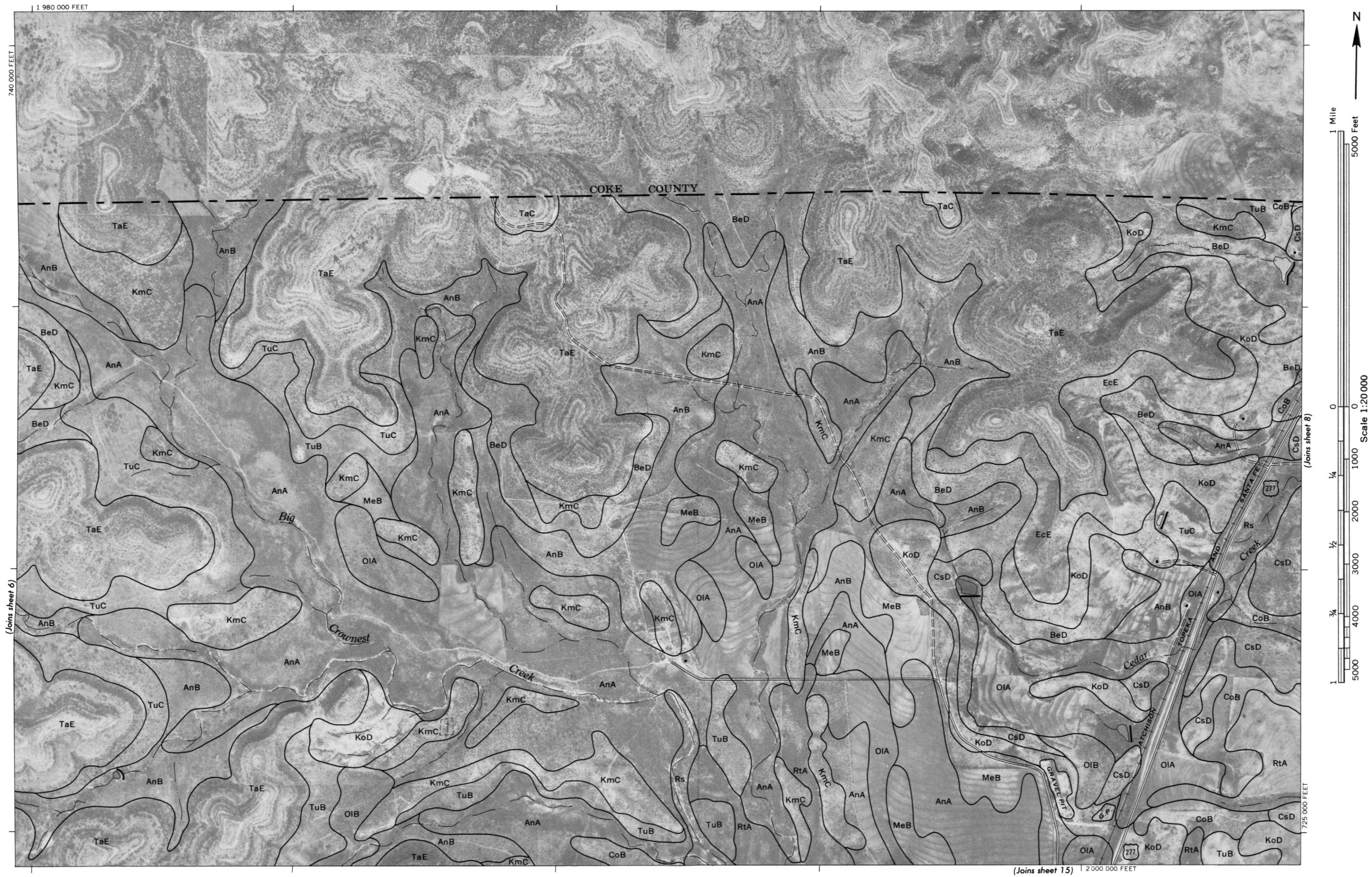
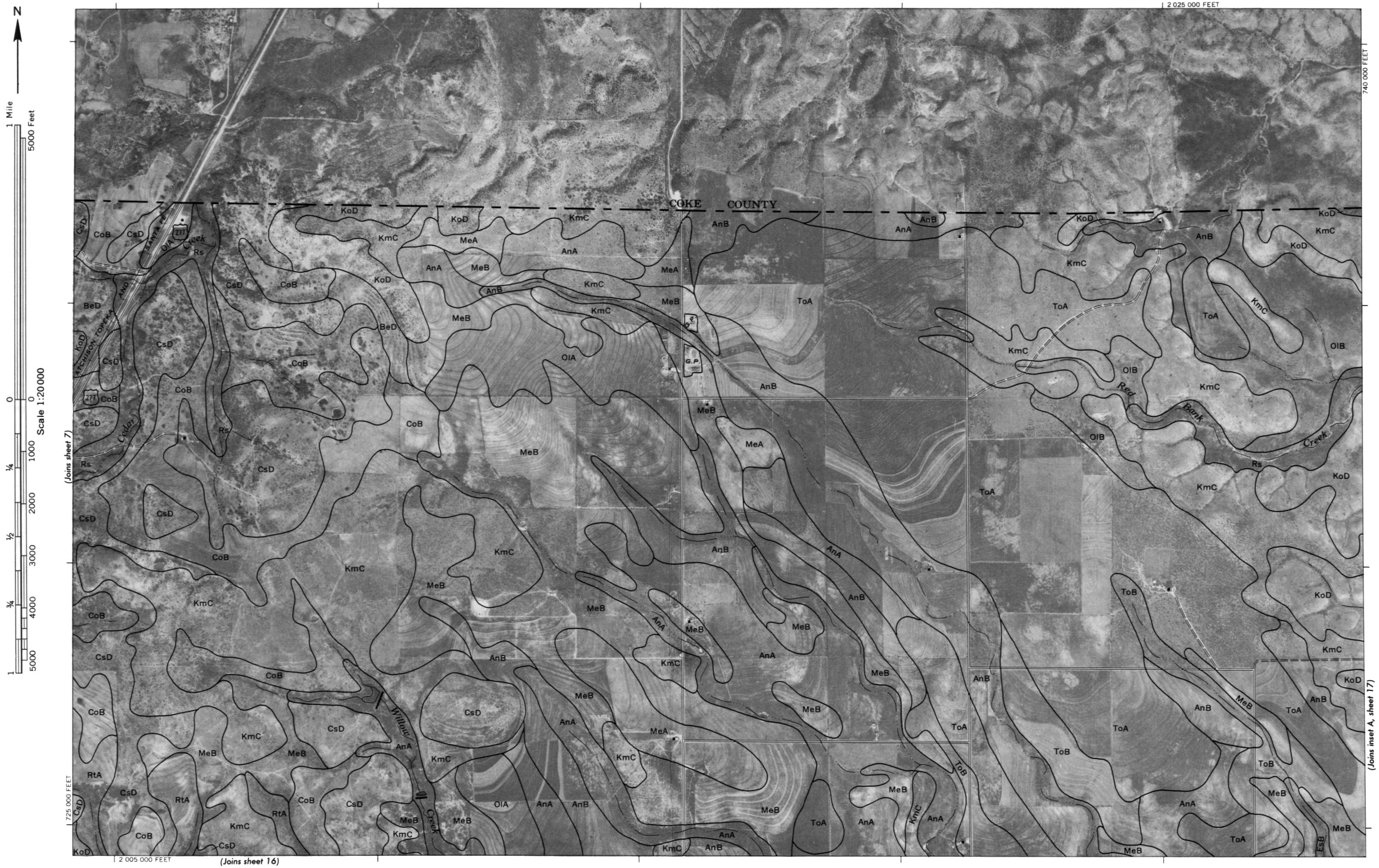


TOM GREEN COUNTY, TEXAS — SHEET NUMBER 8



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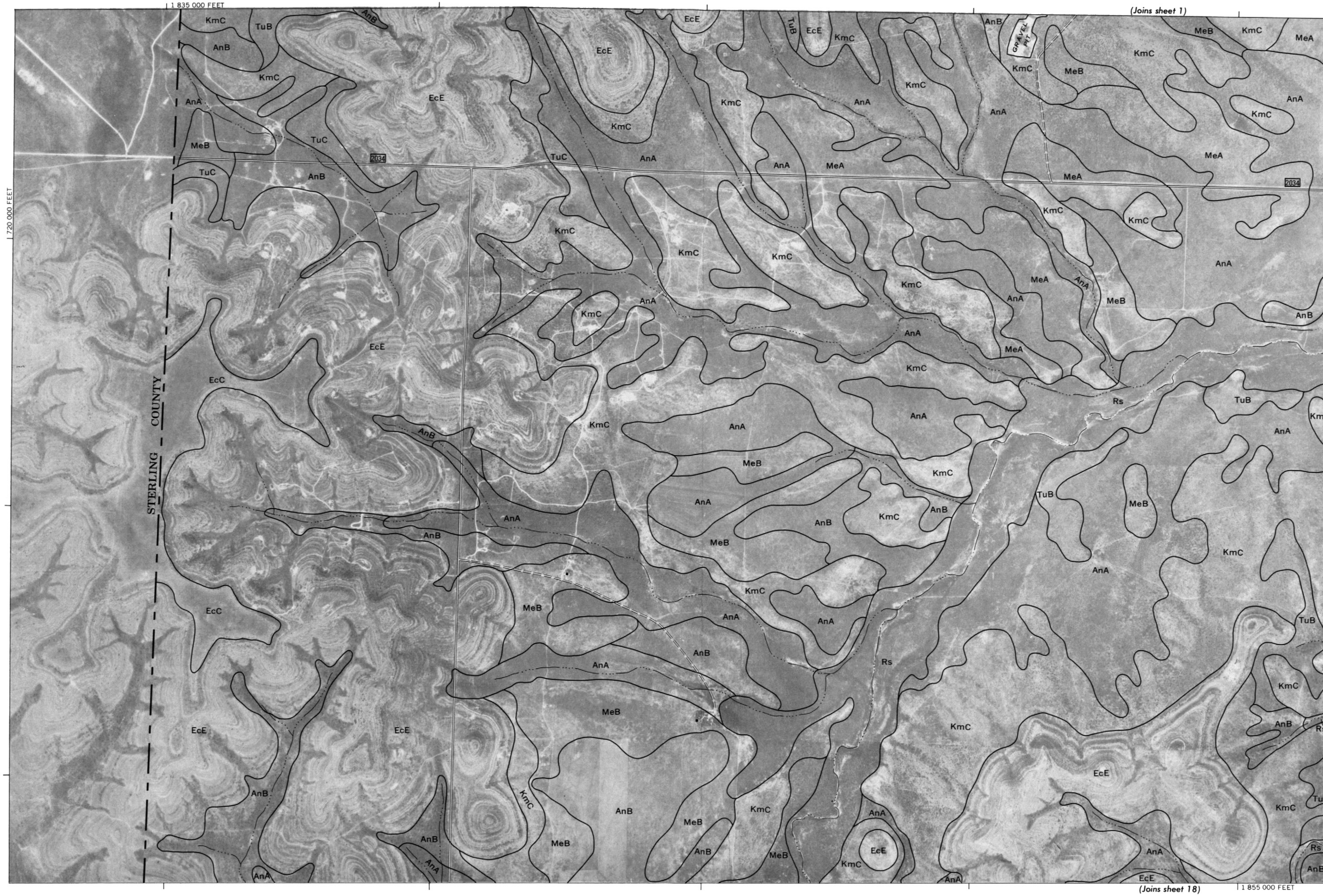

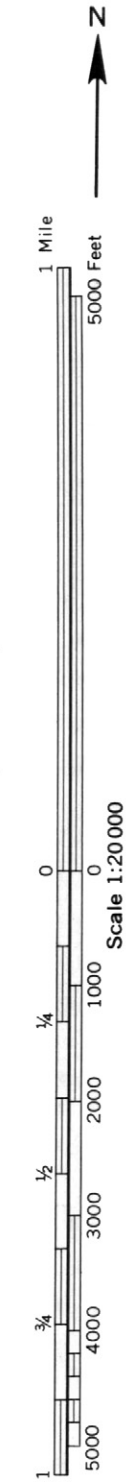

TOM GREEN COUNTY, TEXAS NO. 9

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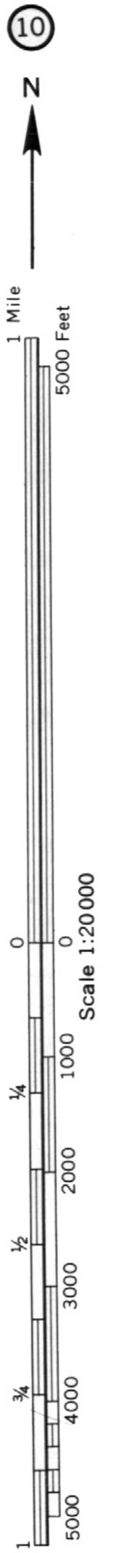
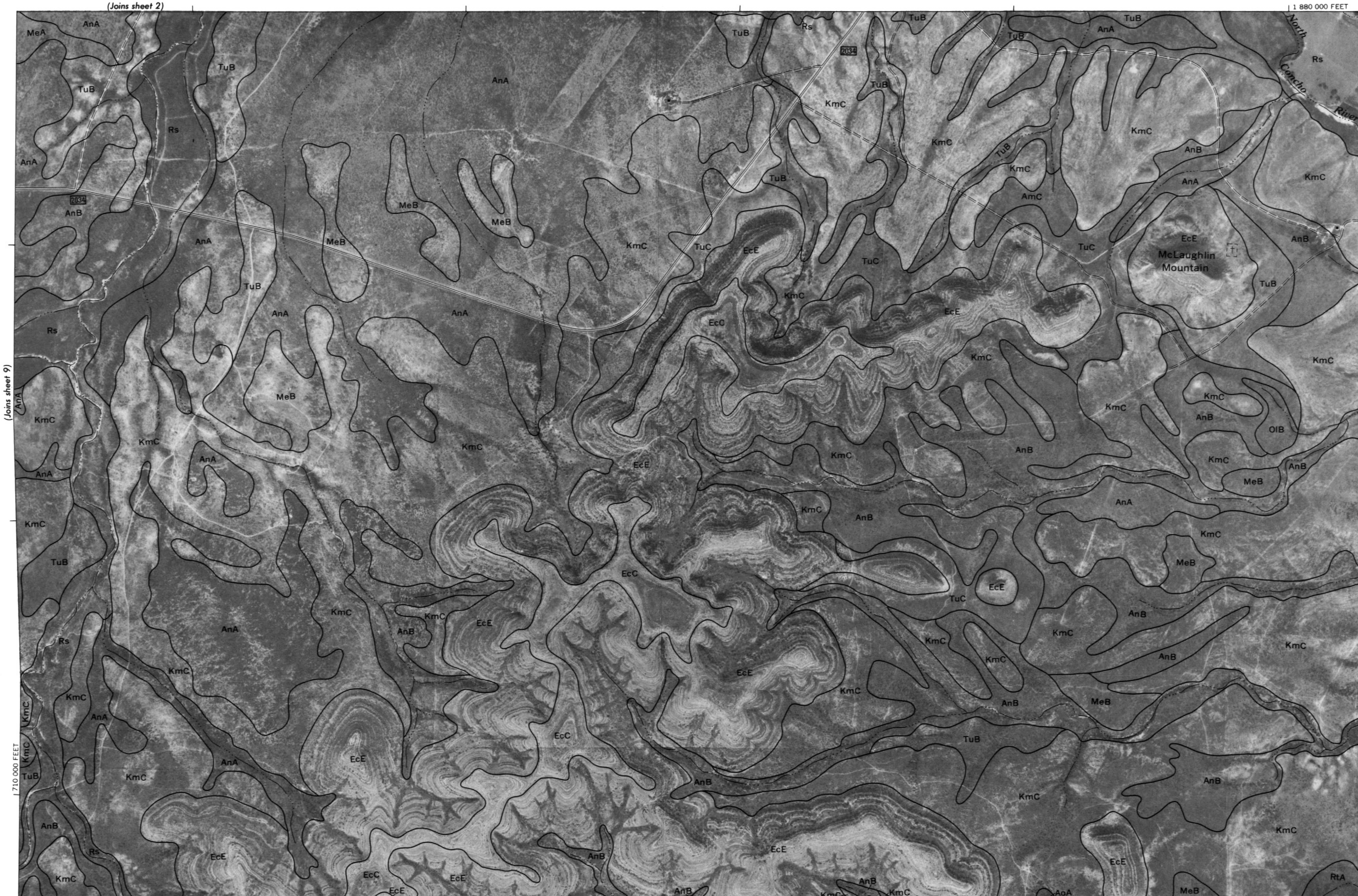


Scale 1:20000



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TOM GREEN COUNTY, TEXAS — SHEET NUMBER 11

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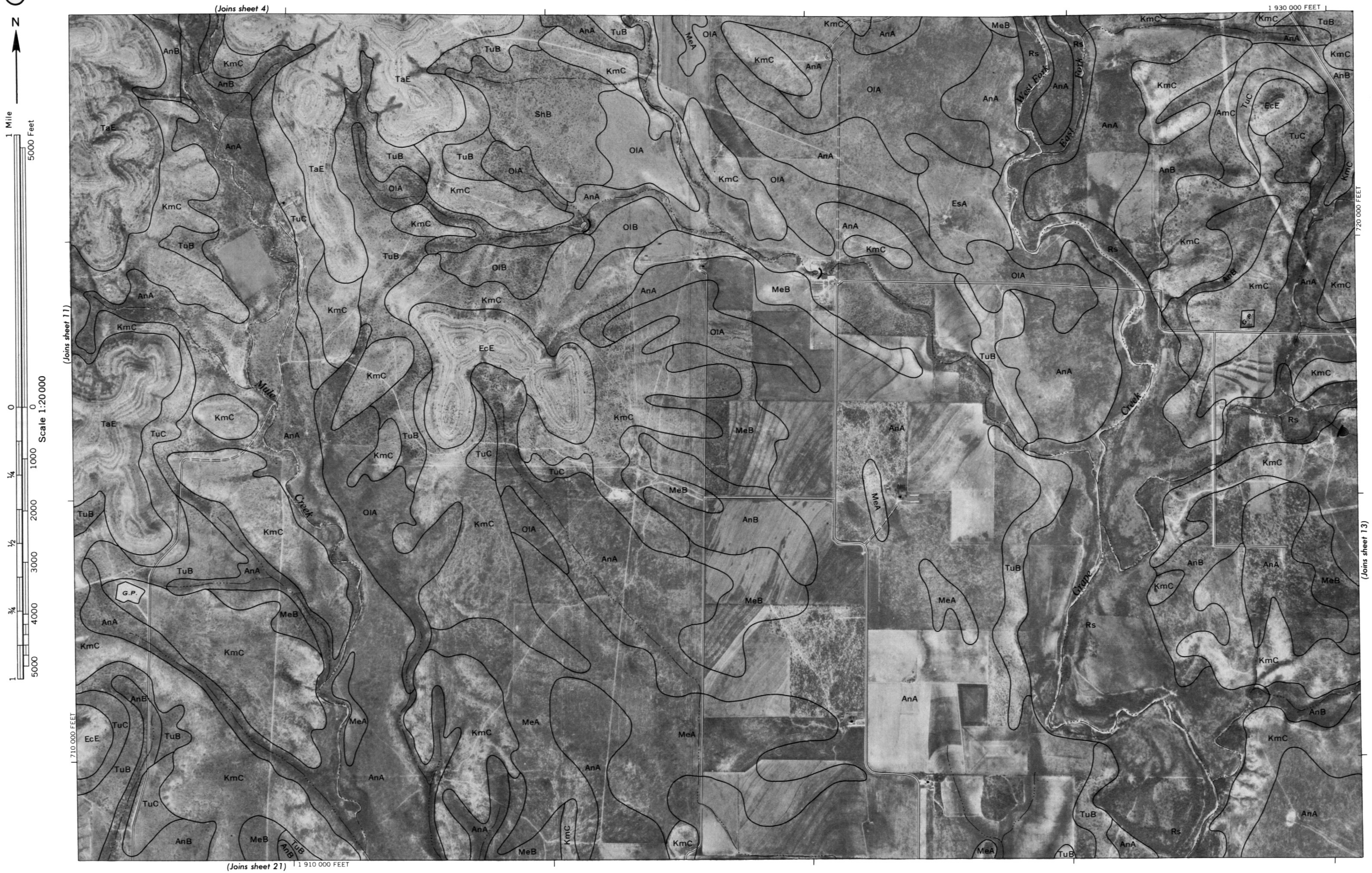

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N

1 Mile
5000 Feet
0
¼
½
¾
1
0
1000
2000
3000
4000
5000
Scale 1:20000

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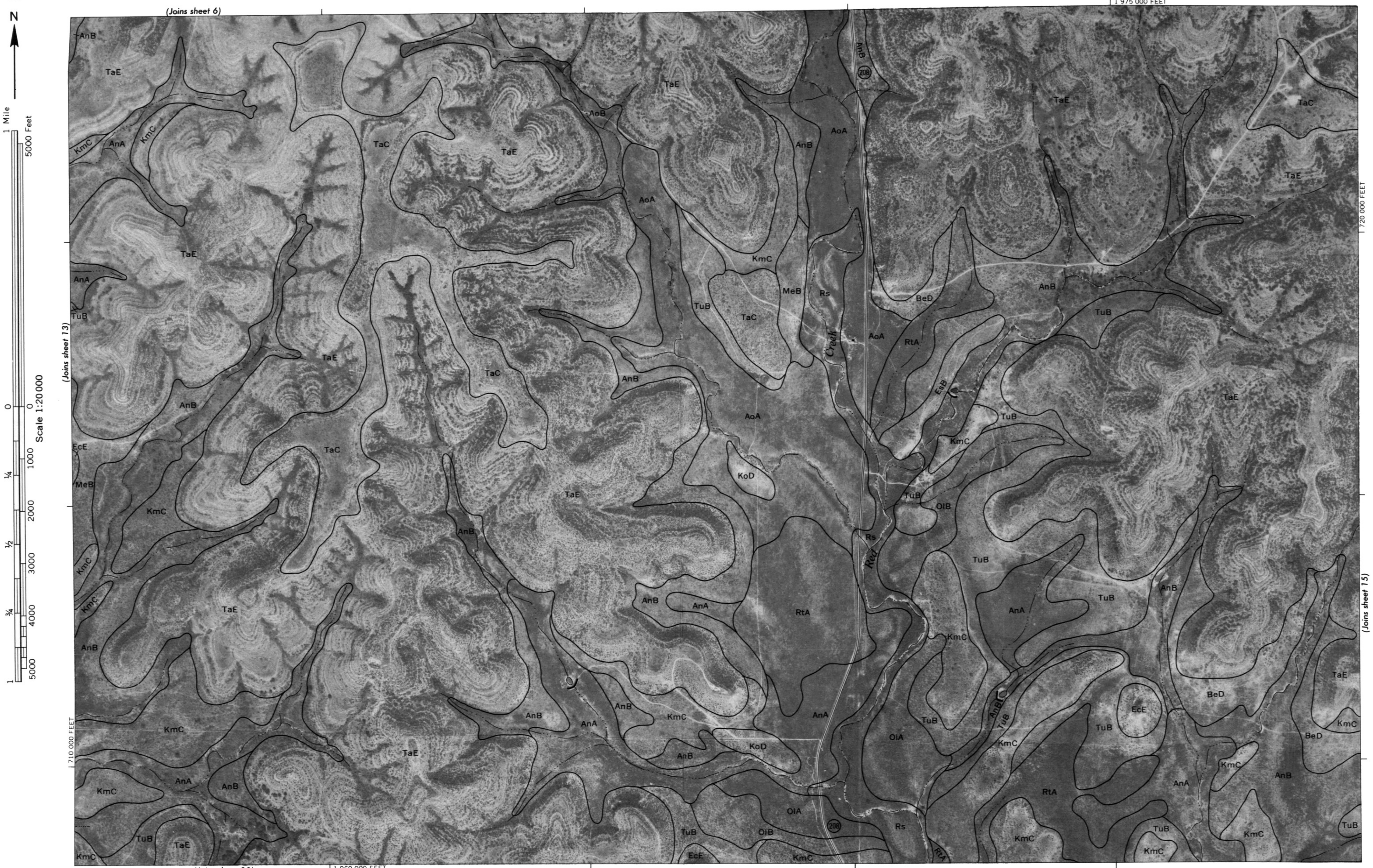

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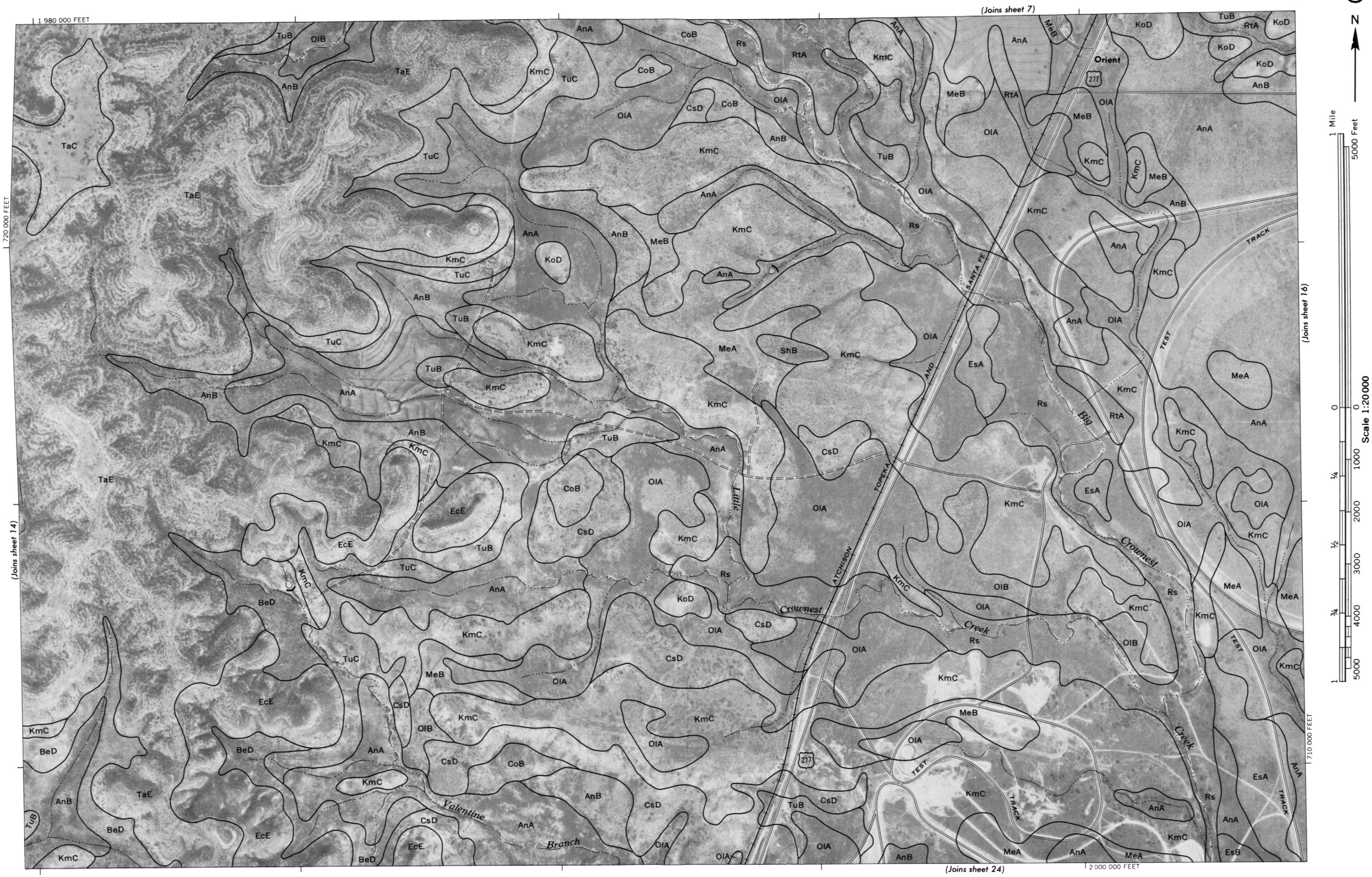
15



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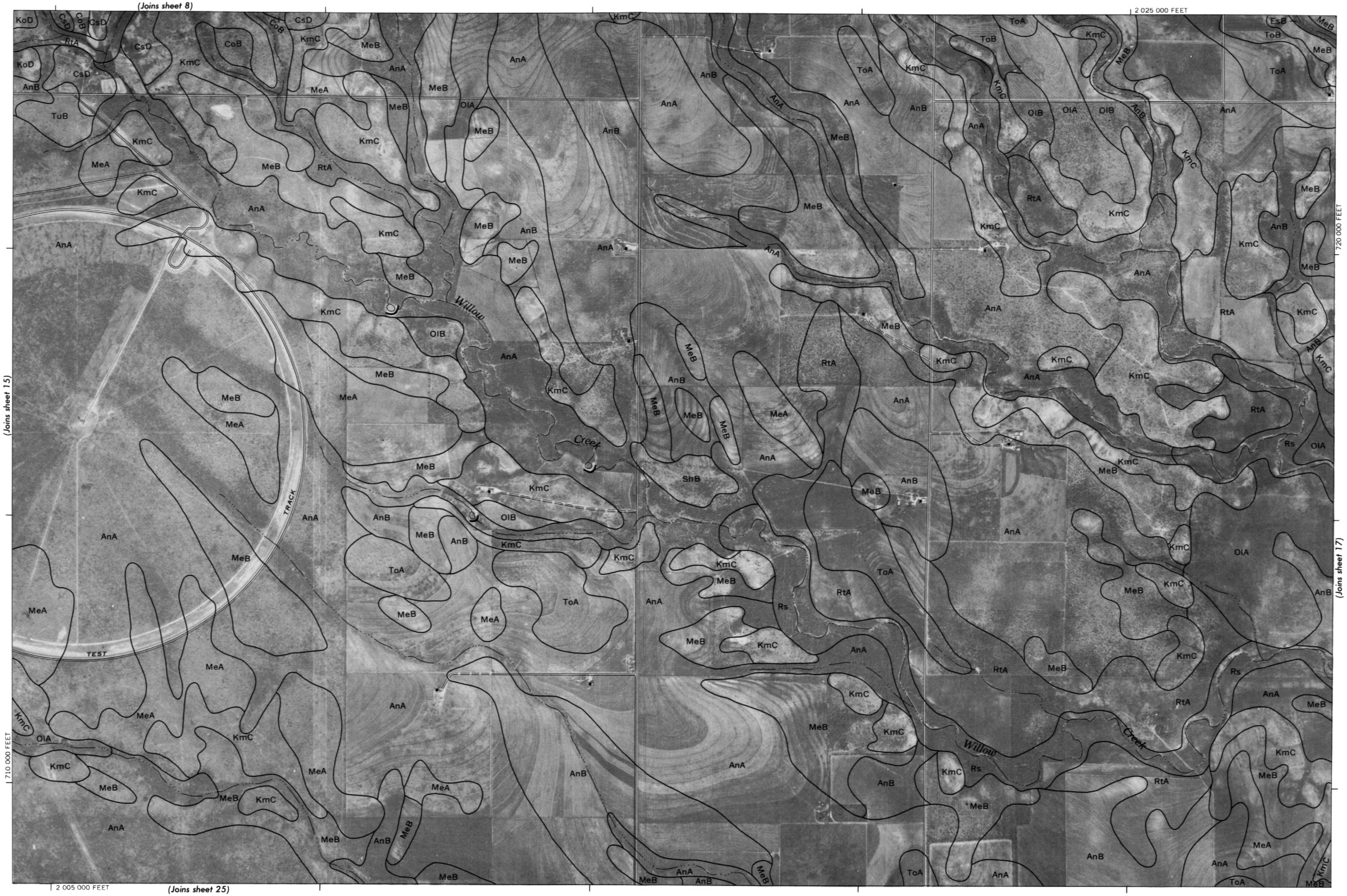
TOM GREEN COUNTY, TEXAS — SHEET NUMBER 16

N

Scale 1:20 000

1 Mile — ¾ — ½ — ¼ — 0

5000 Feet — 4000 — 3000 — 2000 — 1000 — 0 — 5000



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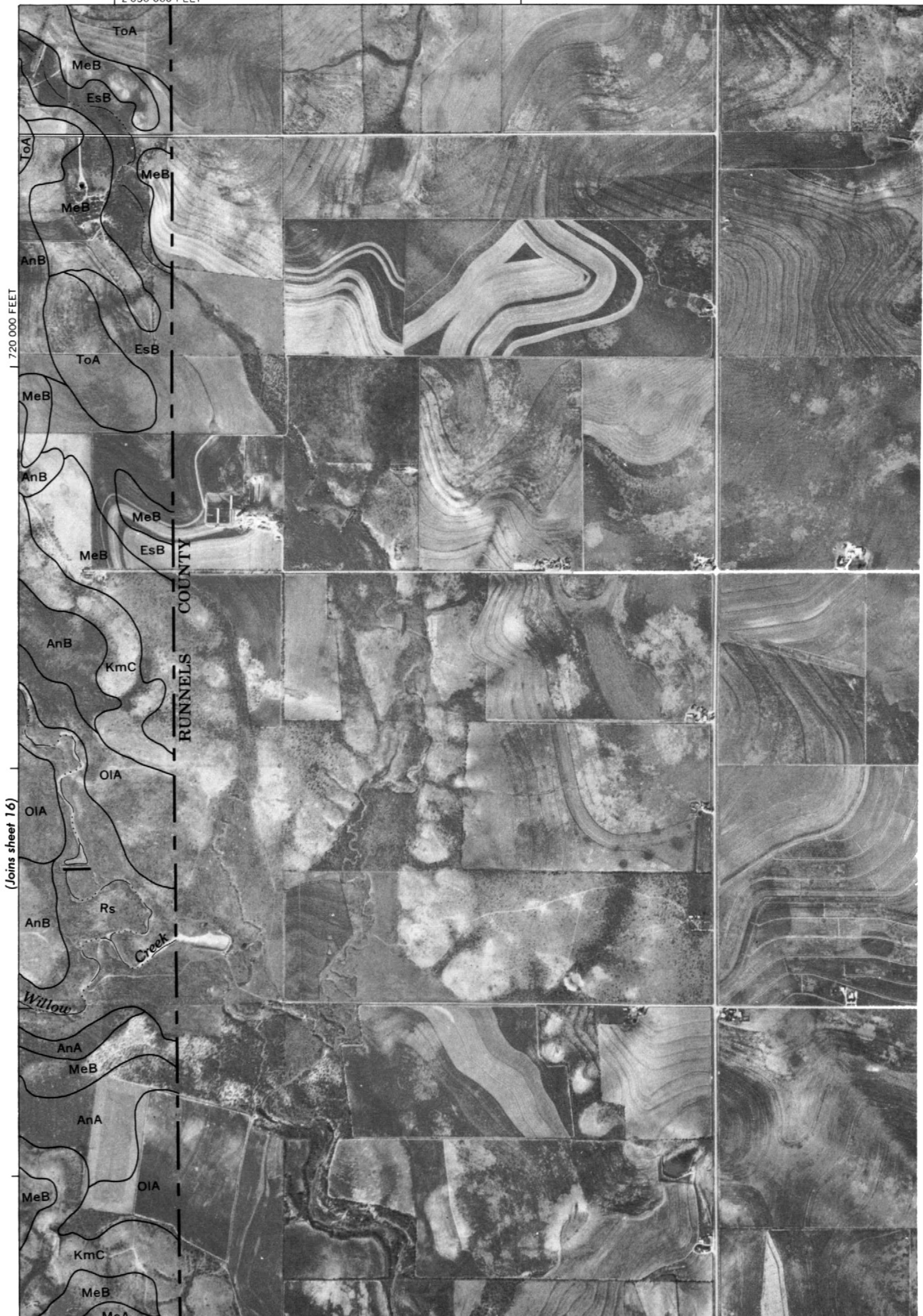
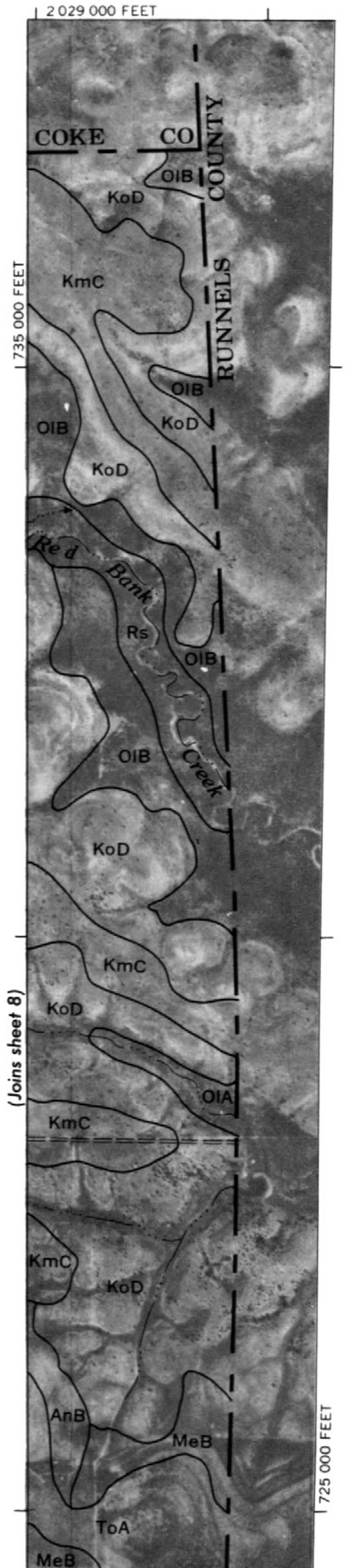
(Joins inset A)



(Joins sheet 16)

(Joins sheet 26)

INSET A

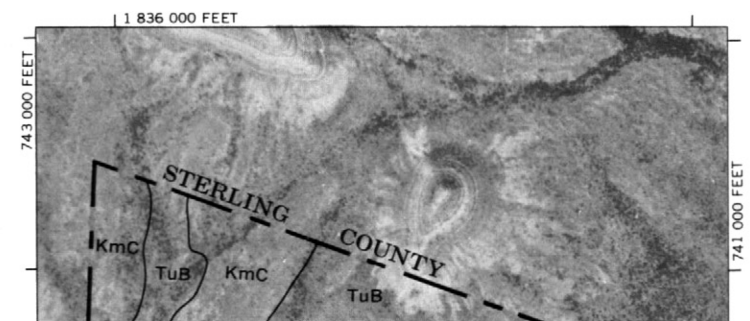


(Joins sheet 8)

(Joins upper left)

2 000 AND 5 000-FOOT GRID TICKS

INSET B



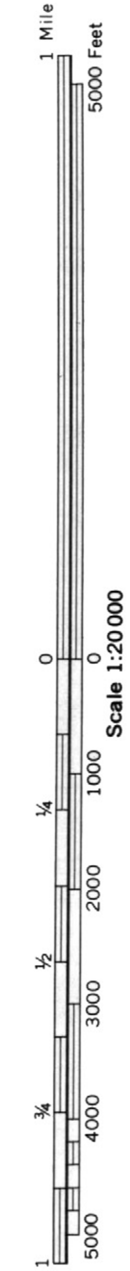
(Joins sheet 1)

2 000 AND 5 000-FOOT GRID TICKS

710 000 FEET

2 050 000 FEET

N



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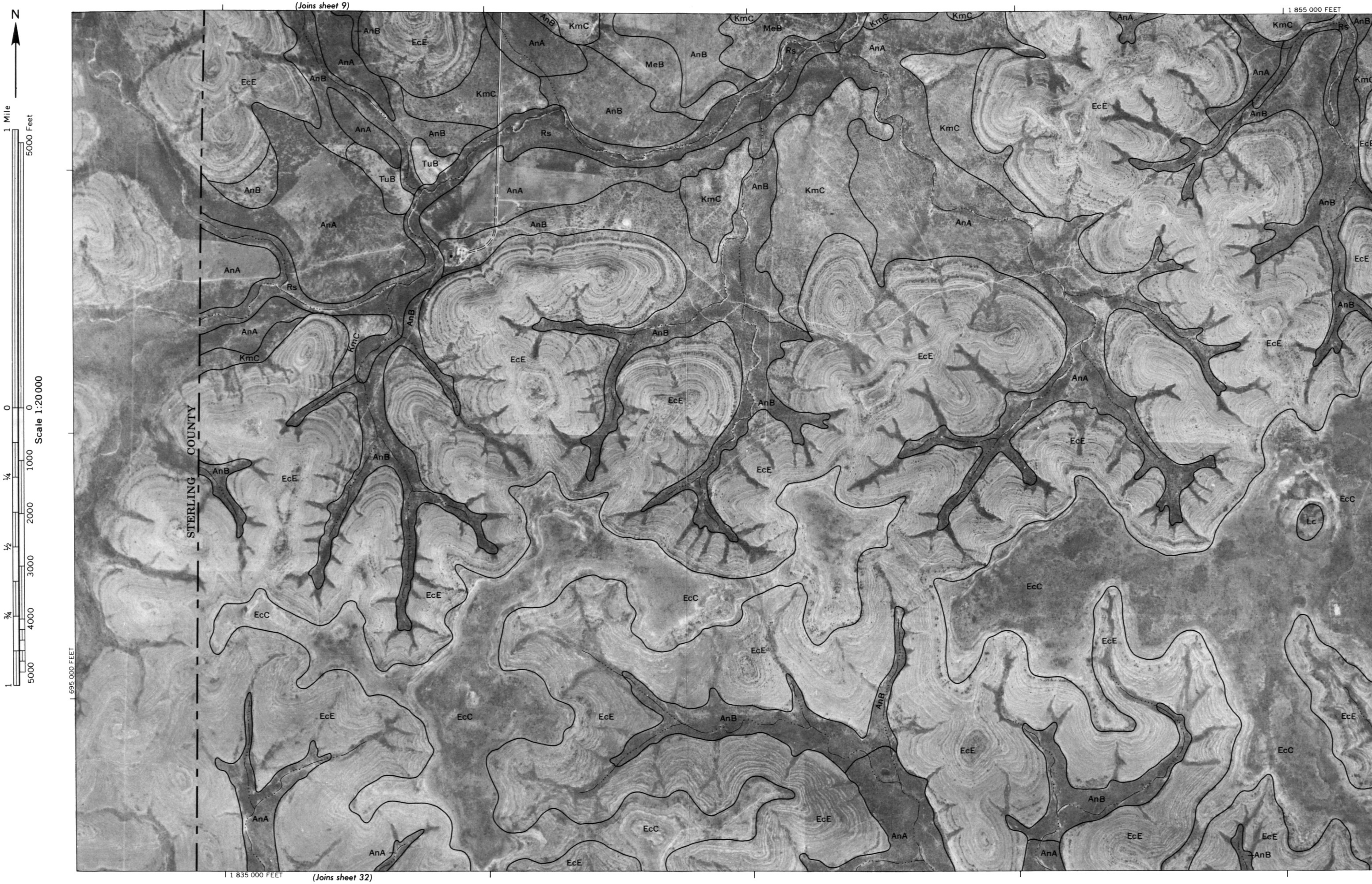

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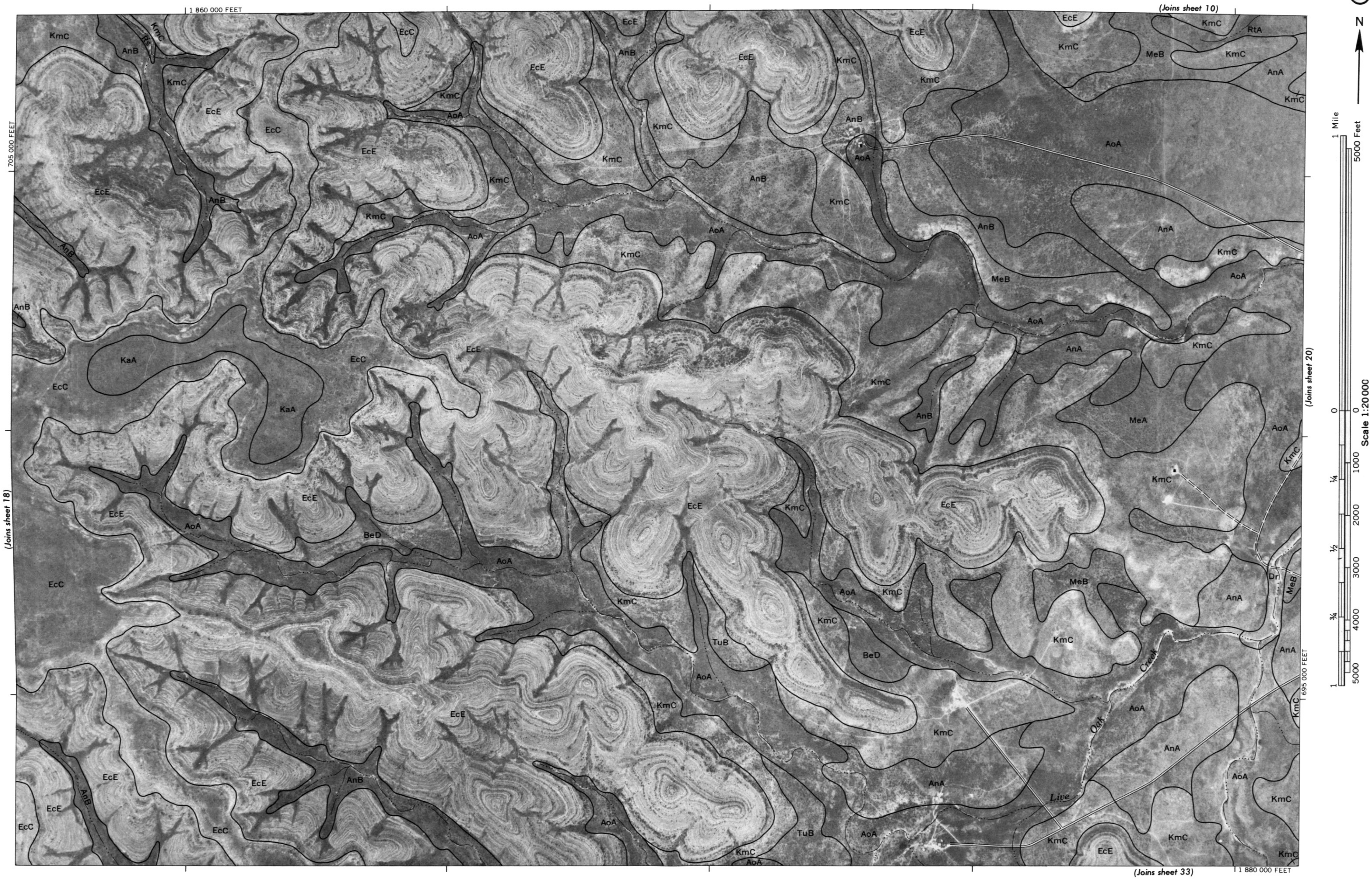
TOM GREEN COUNTY, TEXAS — SHEET NUMBER 19

19



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TOM GREEN COUNTY, TEXAS — SHEET NUMBER 20

N

Scale 1:20 000

1 Mile — 0 — 1/4 — 1/2 — 3/4 — 1

5000 Feet — 0 — 1000 — 2000 — 3000 — 4000 — 5000

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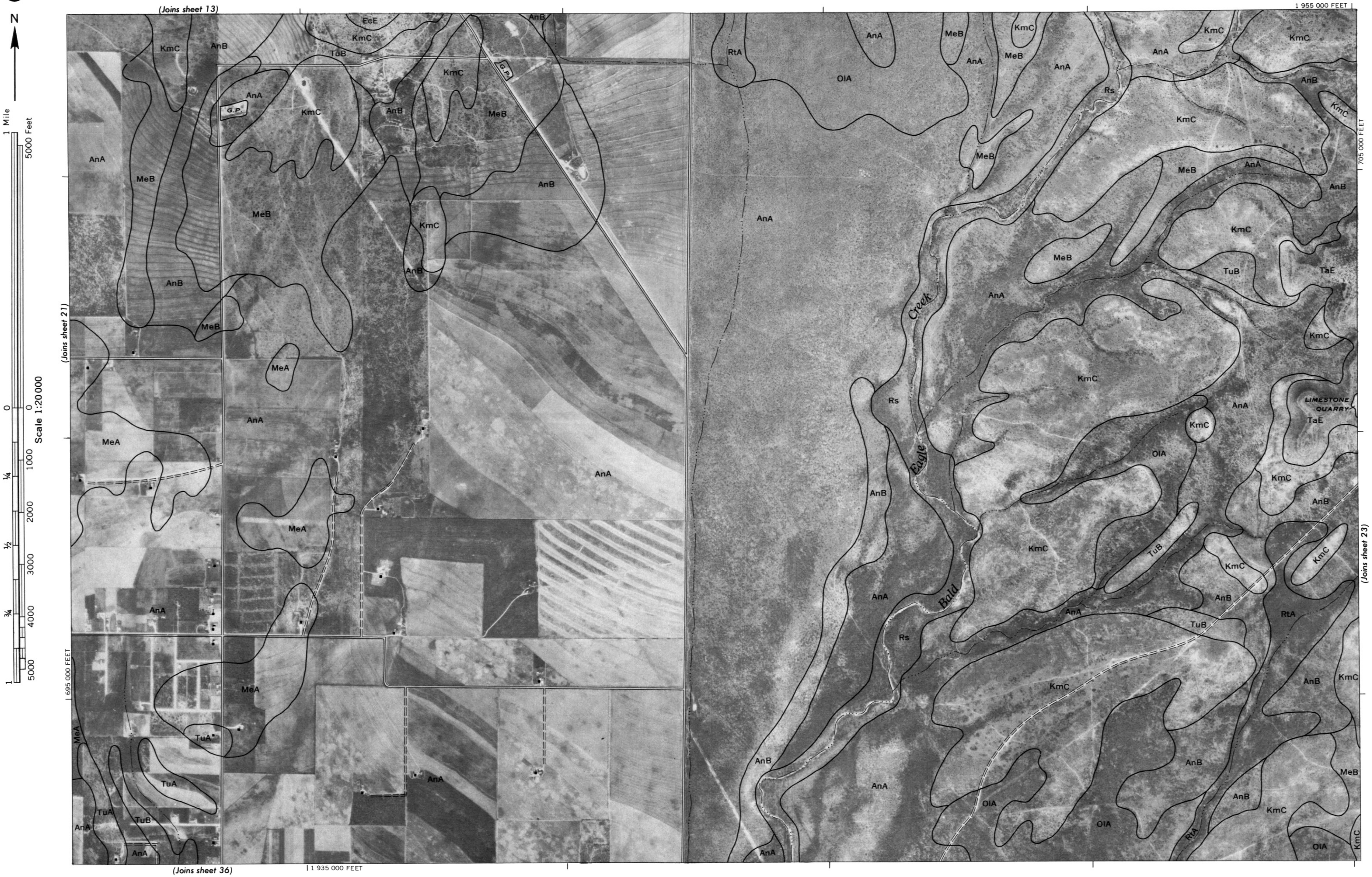
22

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 22



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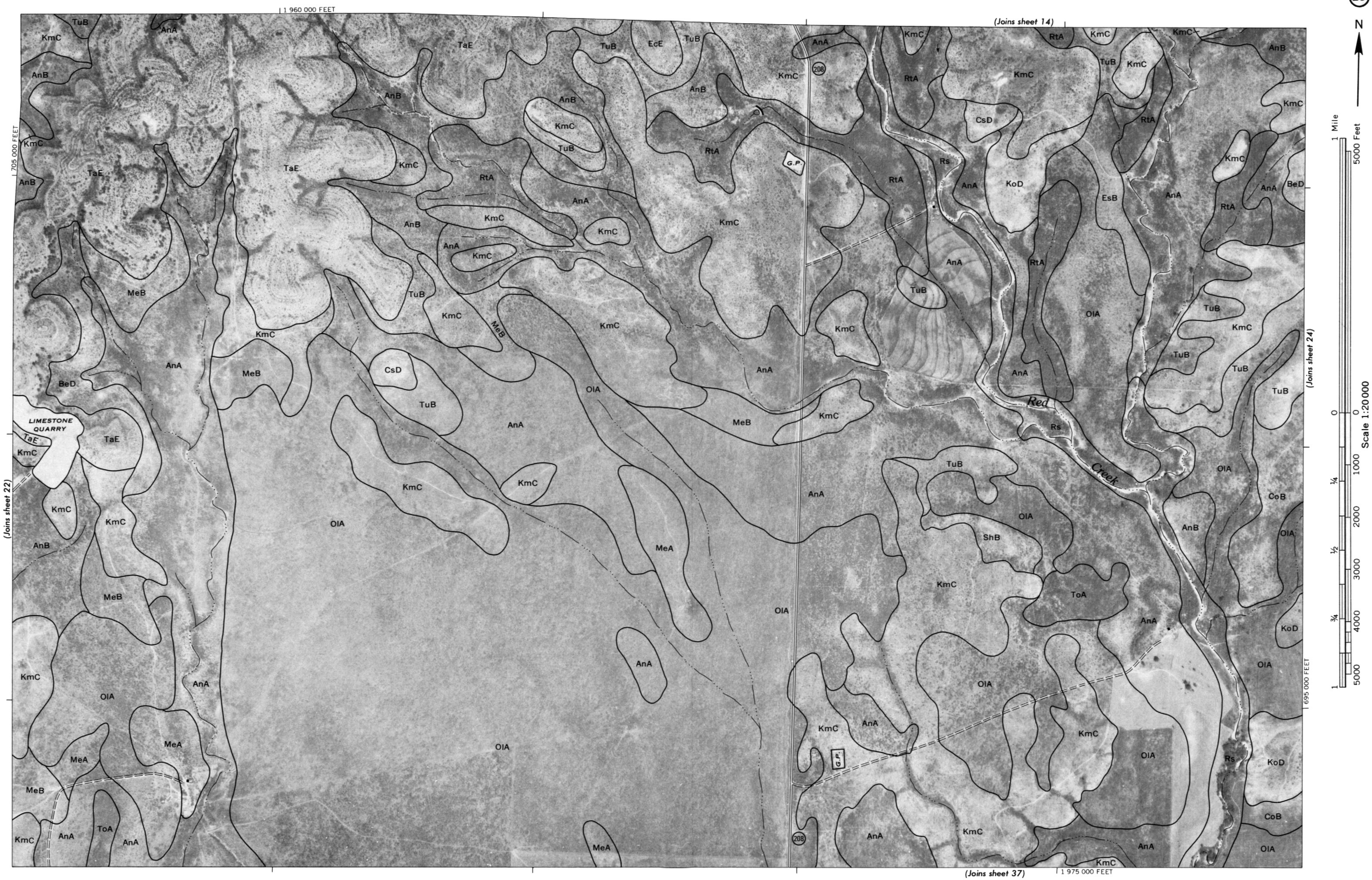
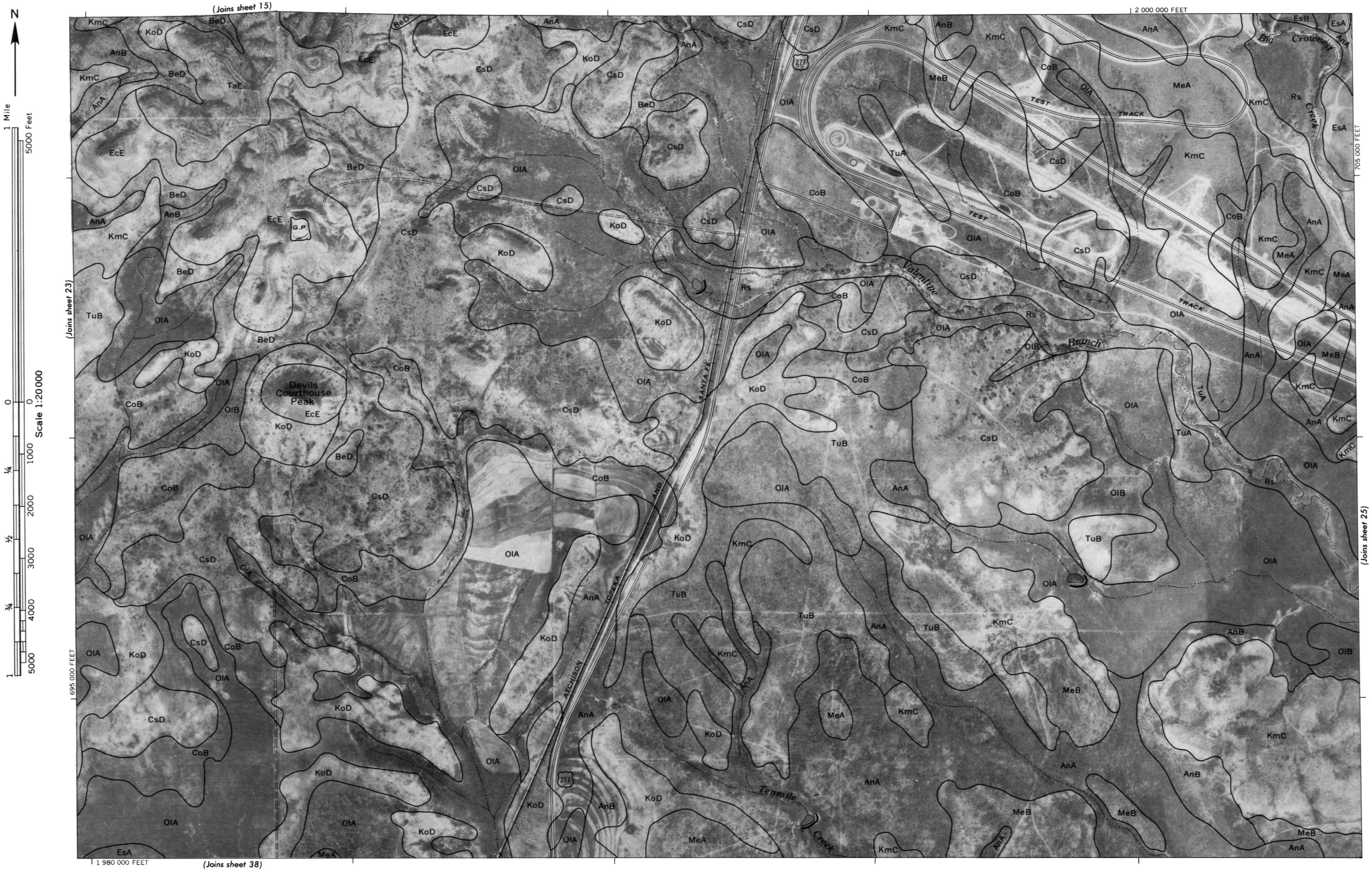


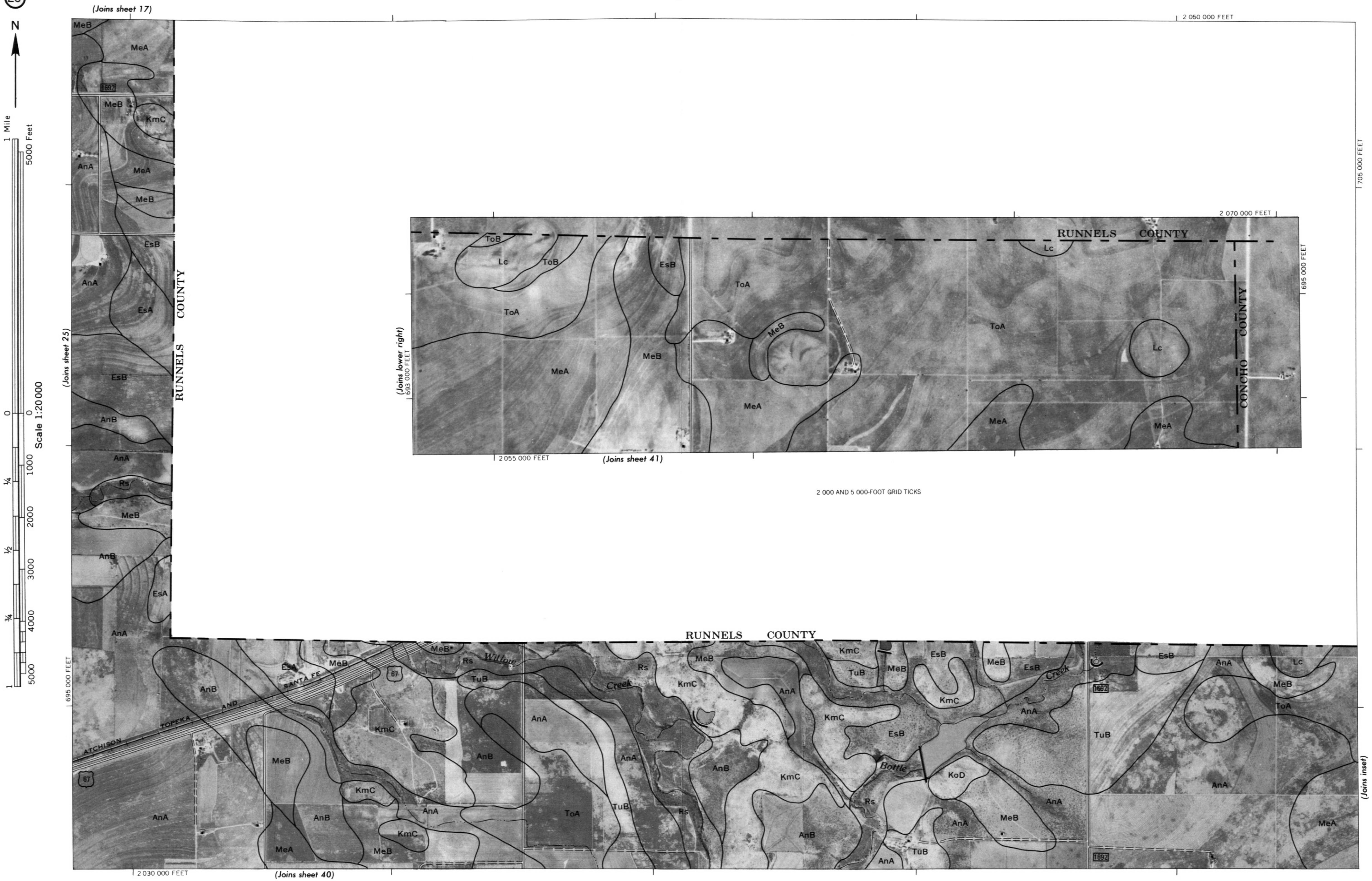


Photobase from 1971 aerial photography. Positions of 5,000–foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 25

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 26



Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 27

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 28

N

Scale 1:20 000

1 Mile ½ ¼ ¾ 0 1

5000 Feet 0 1000 2000 3000 4000 5000

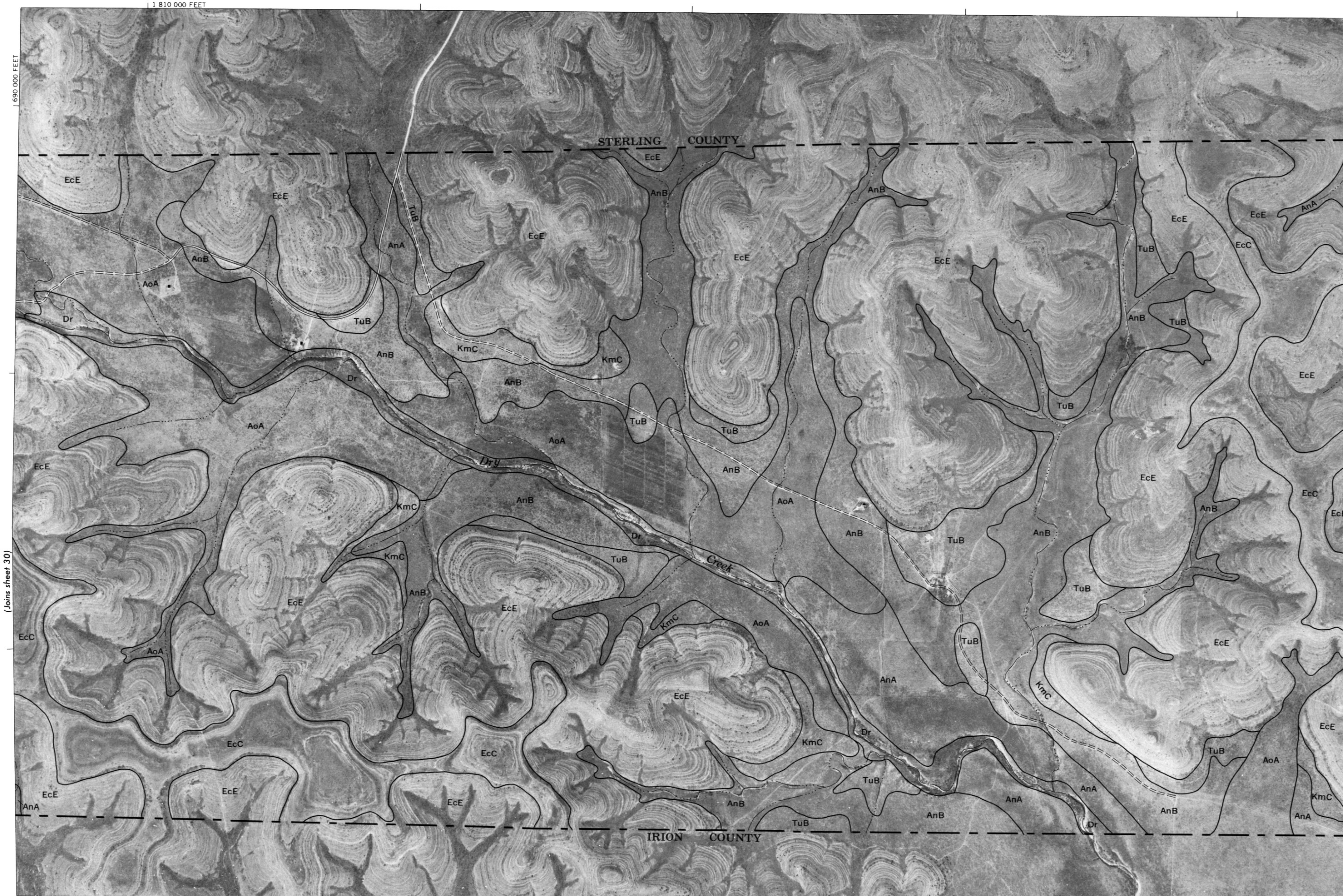
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 30

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.



This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

N

1 Mile
5000 Feet
Scale 1:20000
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

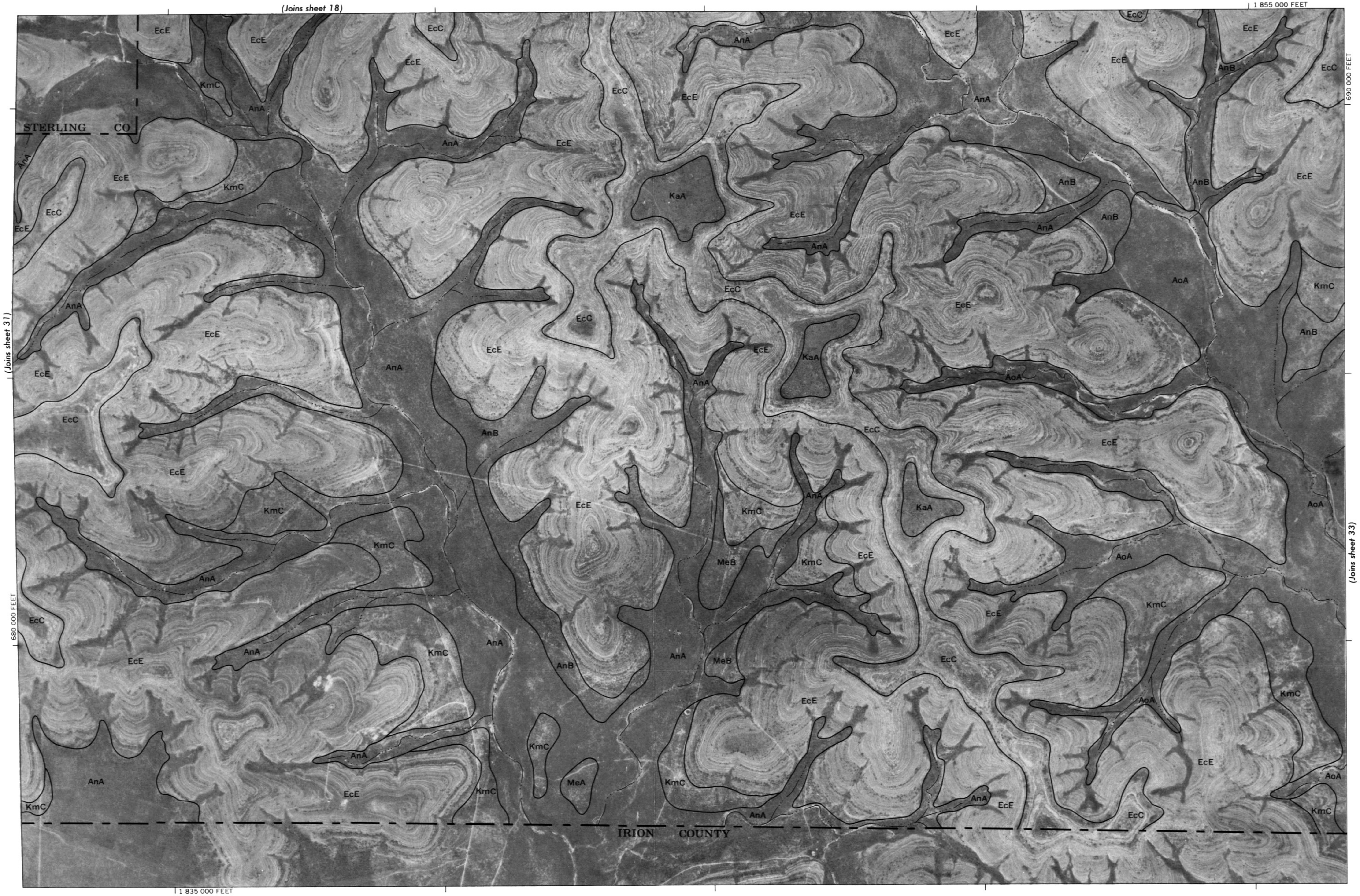
TOM GREEN COUNTY, TEXAS — SHEET NUMBER 32

N

Scale 1:20 000

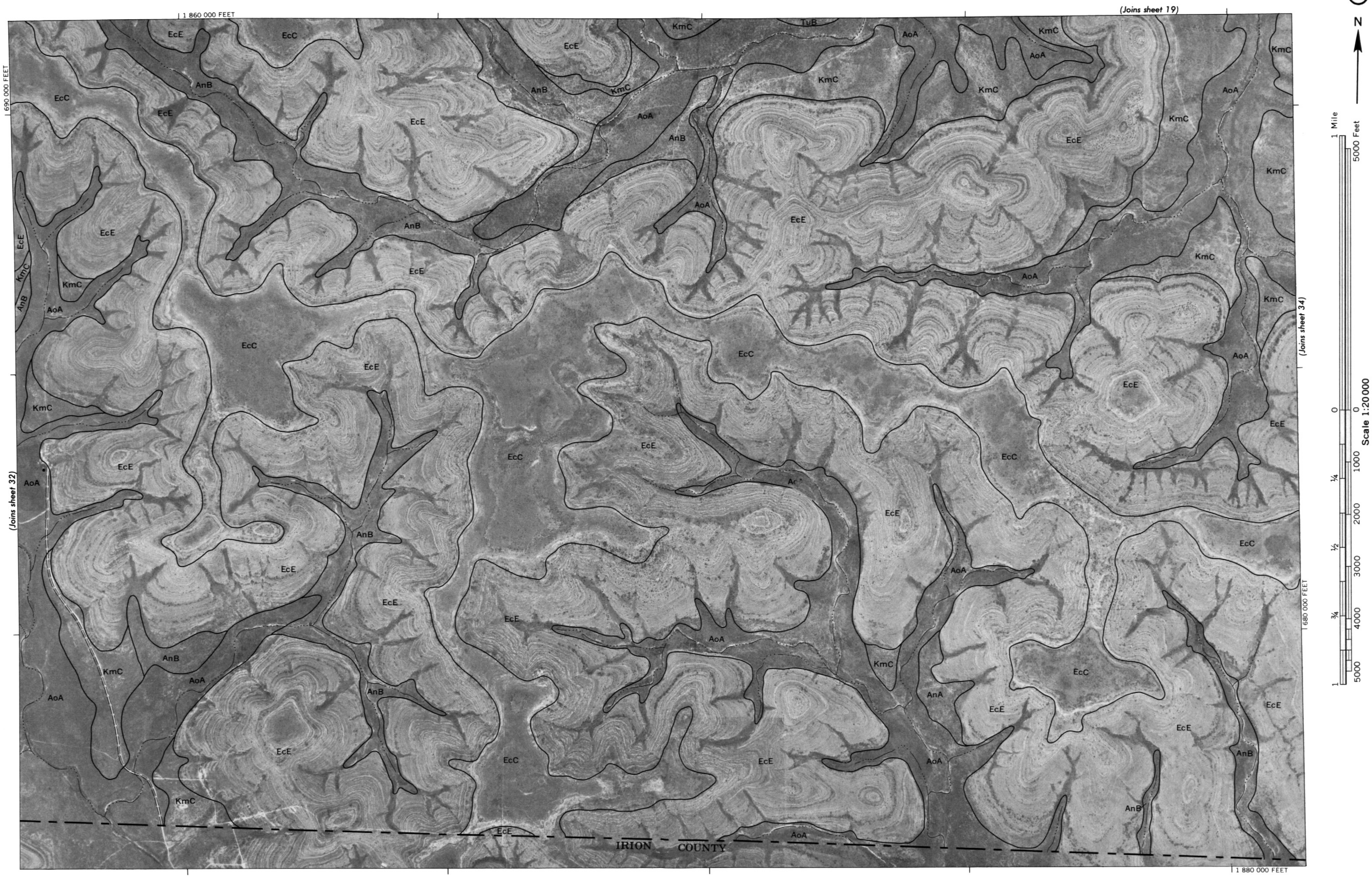
0 ¼ ½ ¾ 1 Mile

0 1000 2000 3000 4000 5000 Feet



Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 33



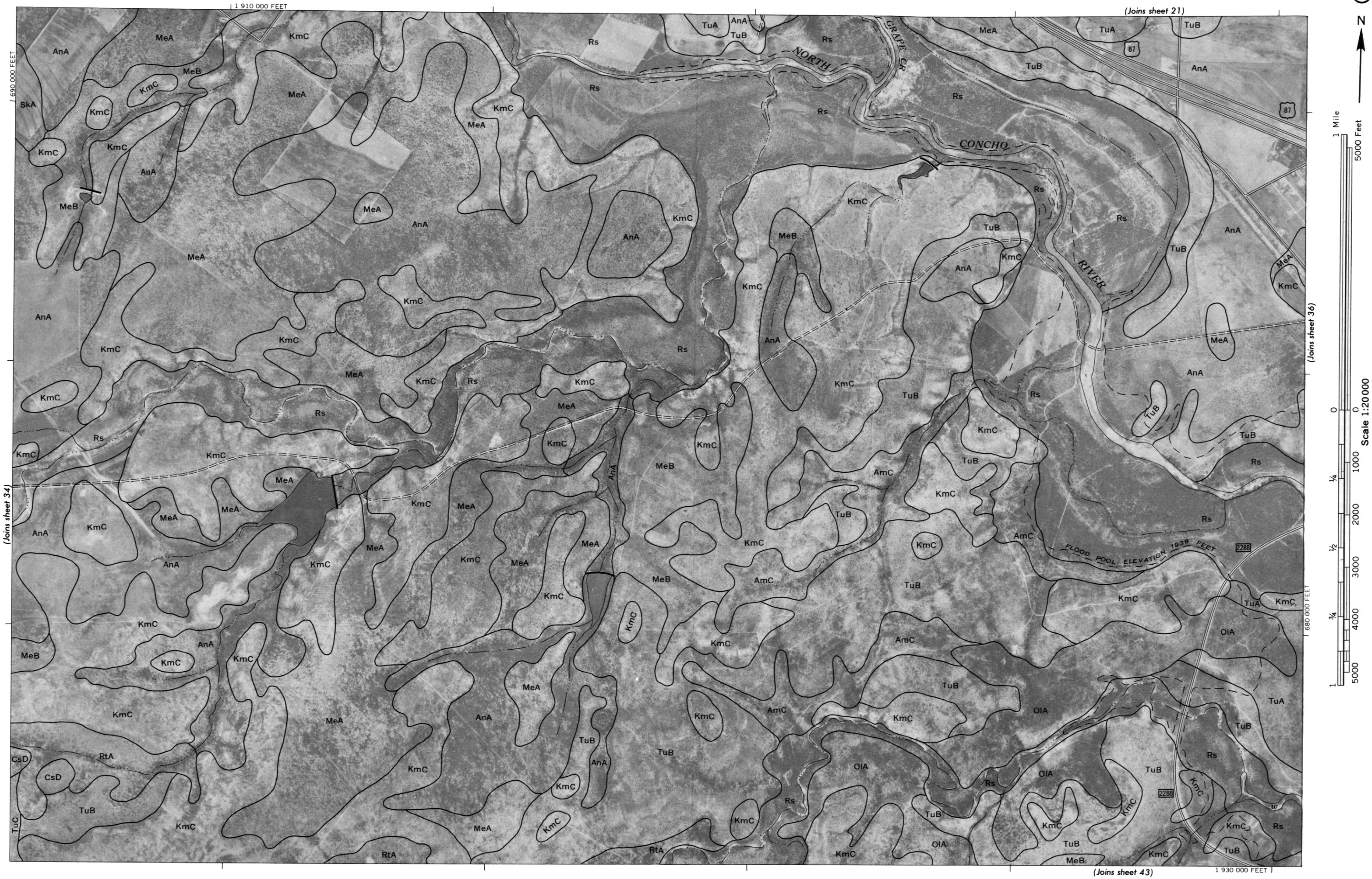
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 34

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

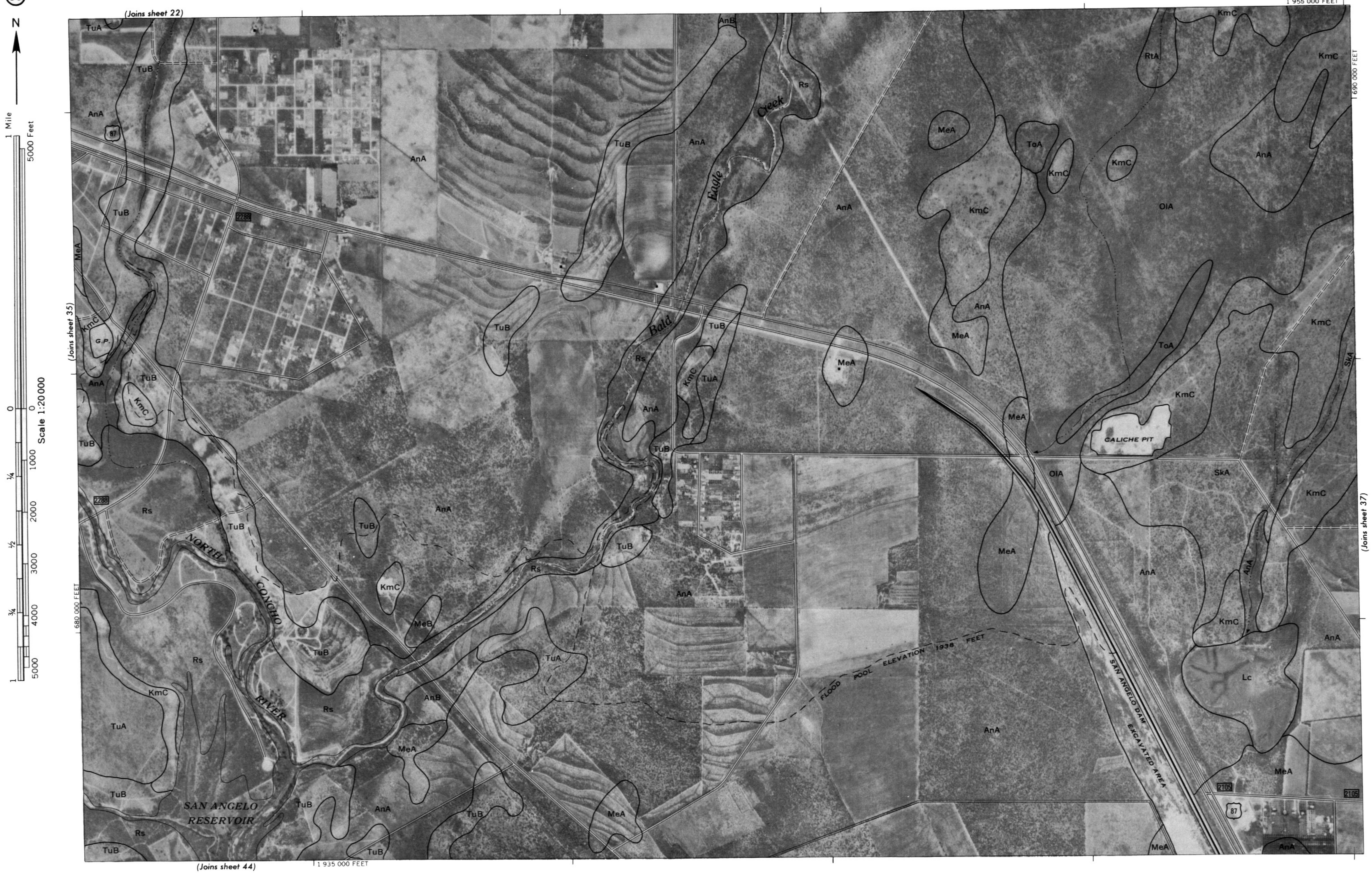
TOM GREEN COUNTY, TEXAS — SHEET NUMBER 35



This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

36

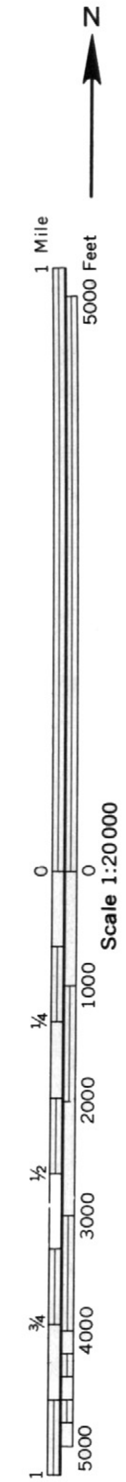
TOM GREEN COUNTY, TEXAS — SHEET NUMBER 36



Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.



This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

N

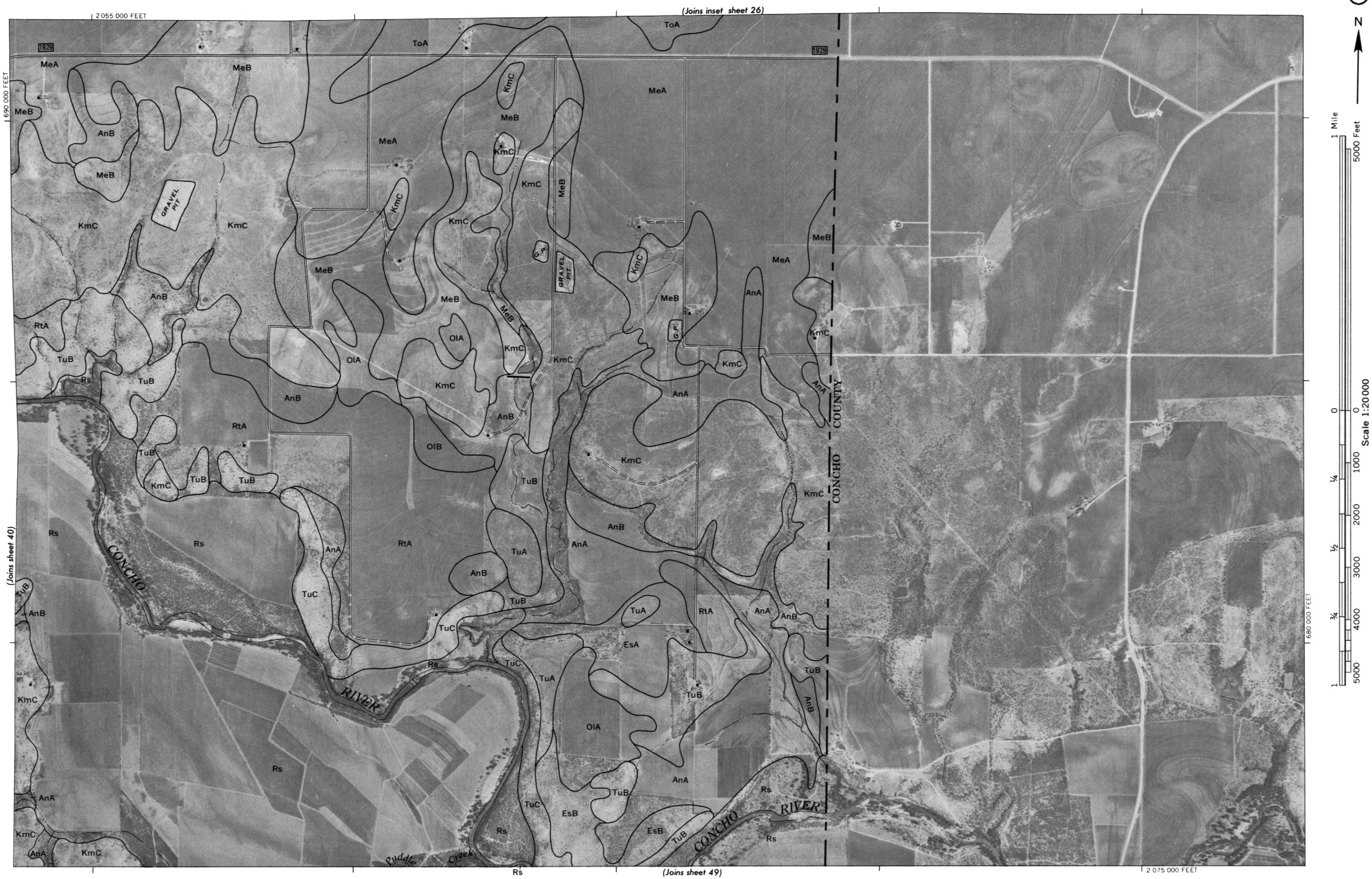
Scale 1:20 000

1 Mile — ¾ — ½ — ¼ — 0

5000 Feet — 4000 — 3000 — 2000 — 1000 — 0

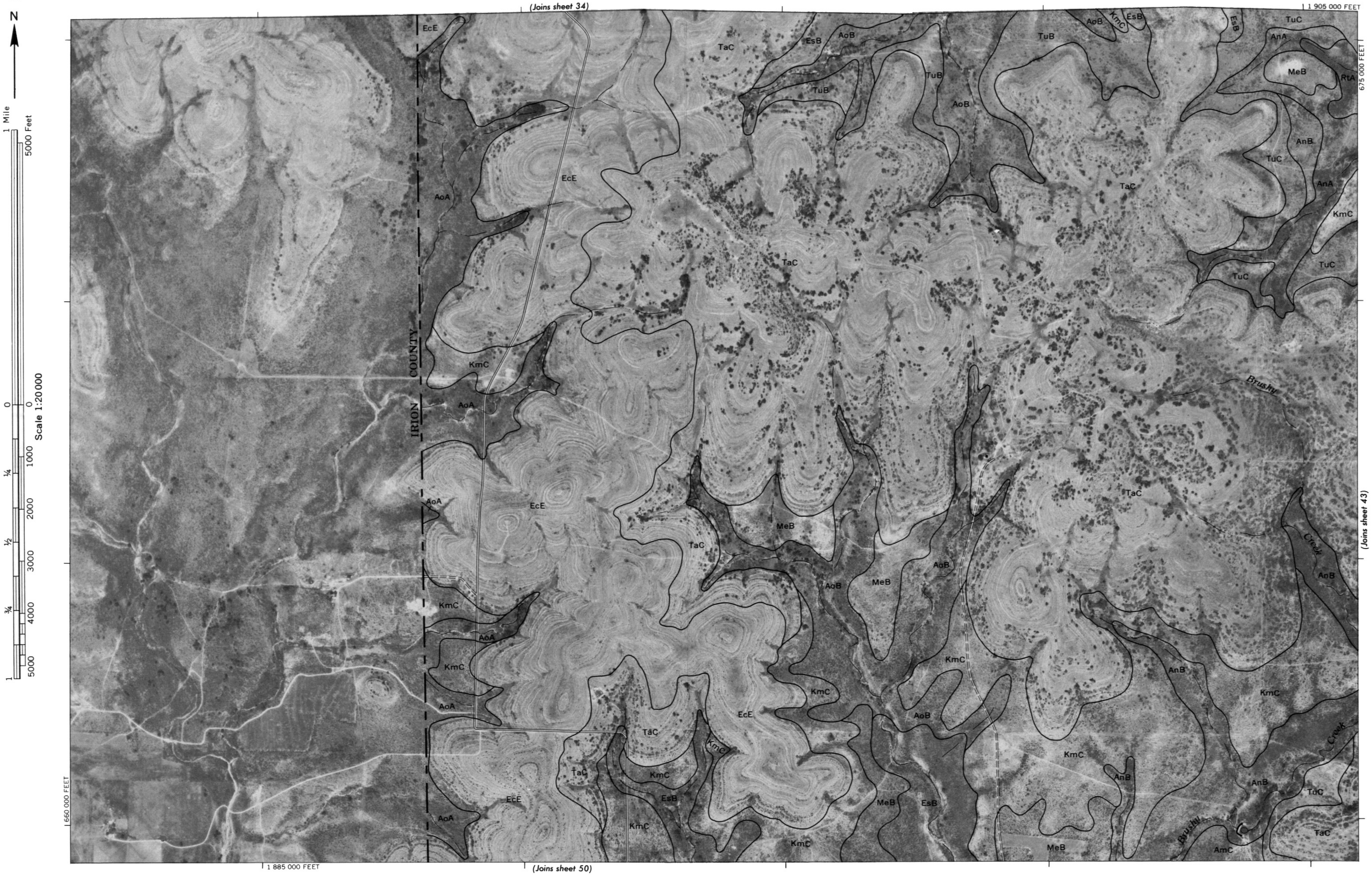
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.



This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 42



Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

N

1 Mile
5000 Feet
0
0
Scale 1:20 000
1000
¼
2000
½
3000
¾
4000
5000
1

(Joins sheet 36)

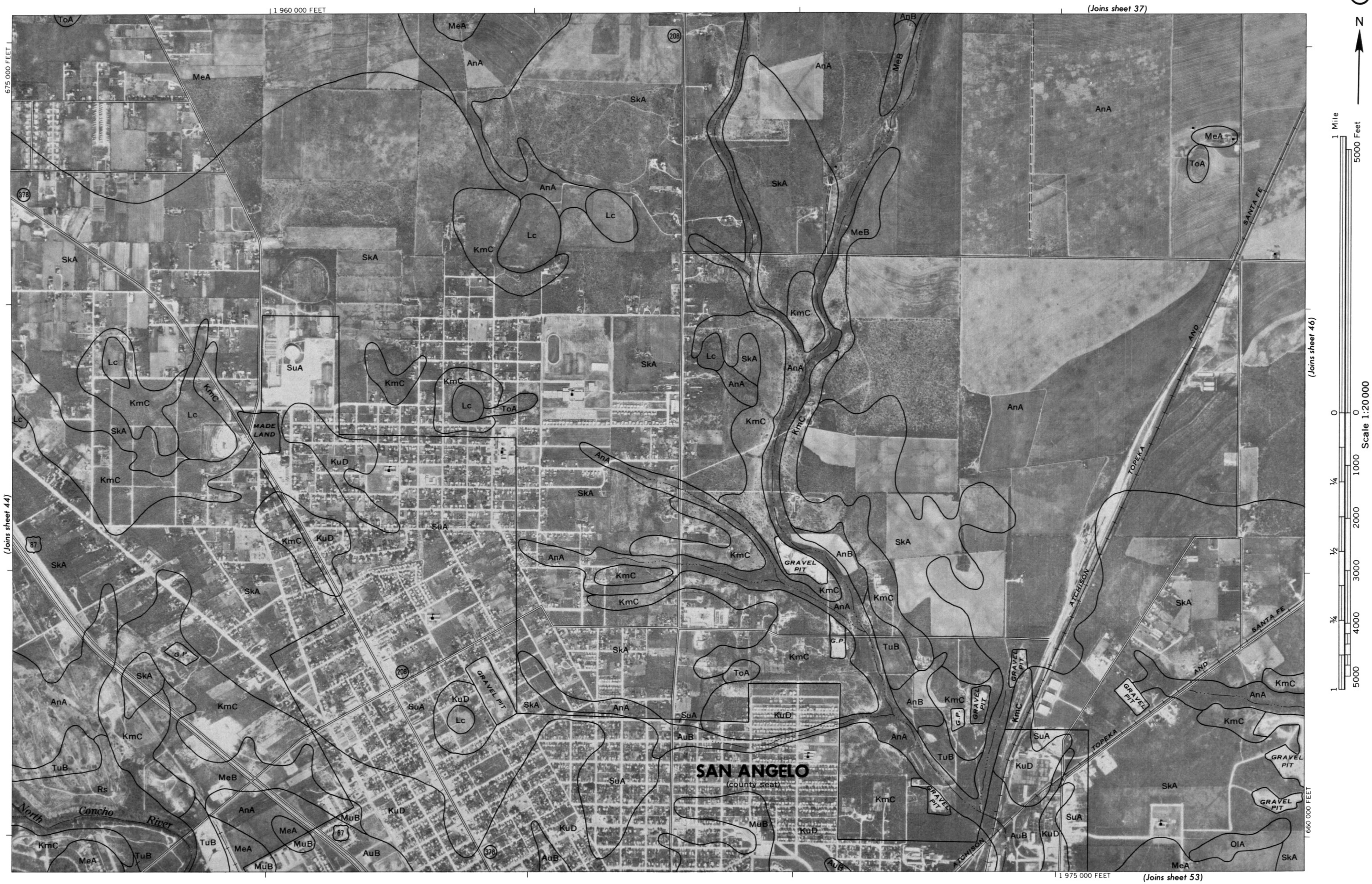
(Joins sheet 43)

(Joins sheet 45)

(Joins sheet 52)

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 45



This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 48

N

1 Mile
5000 Feet
Scale 1:20 000
0 0 1000 ¼ 2000 ½ 3000 ¾ 4000 5000 1

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

N

Scale 1:20 000

0 ¼ ½ ¾ 1 Mile

0 1000 2000 3000 4000 5000 5000 Feet

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 50

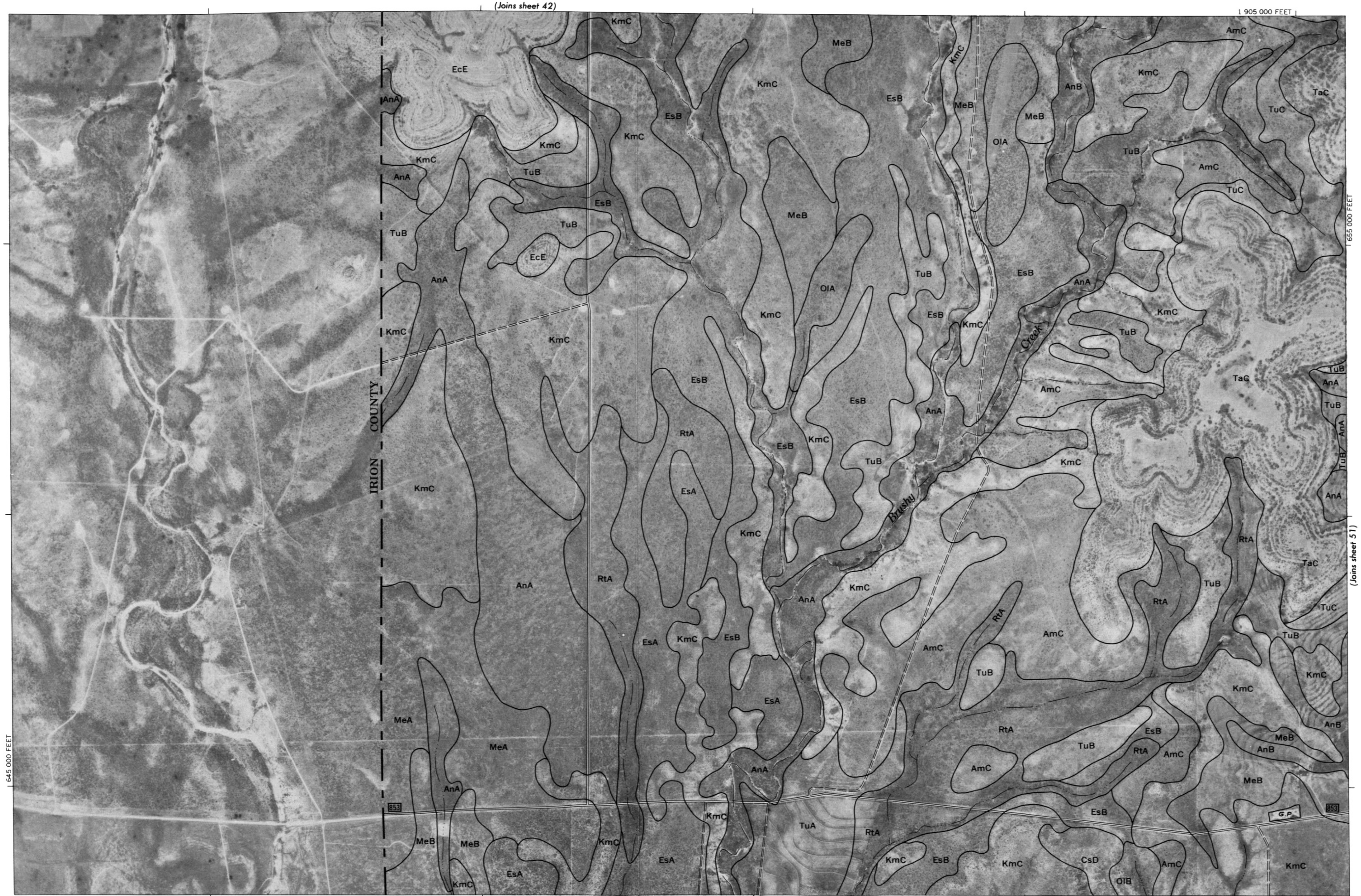
N

1 Mile 5000 Feet

Scale 1:20 000

0 0 1000 ¼ 2000 ½ 3000 ¾ 4000 1 5000

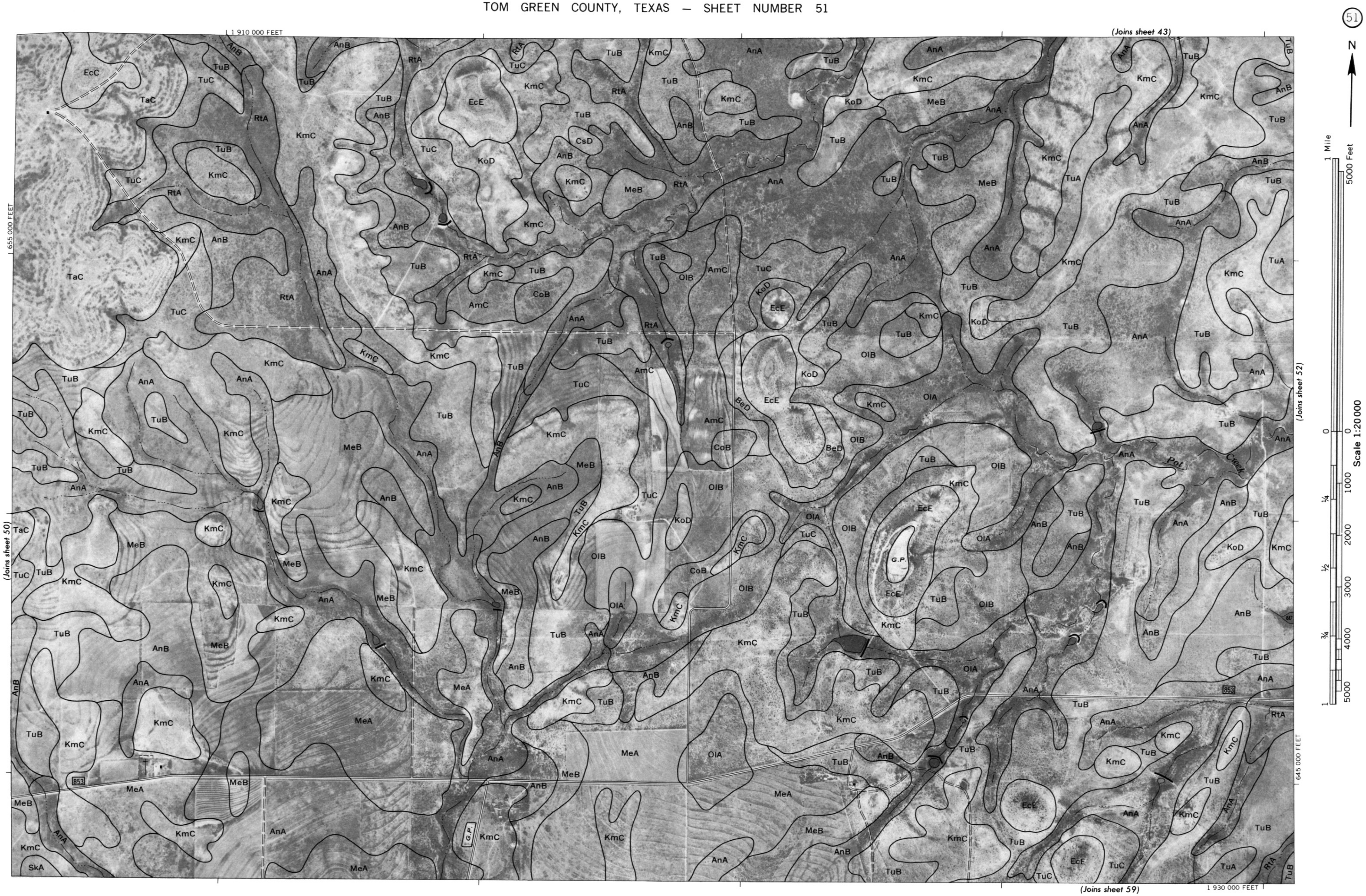
(Joins sheet 42)



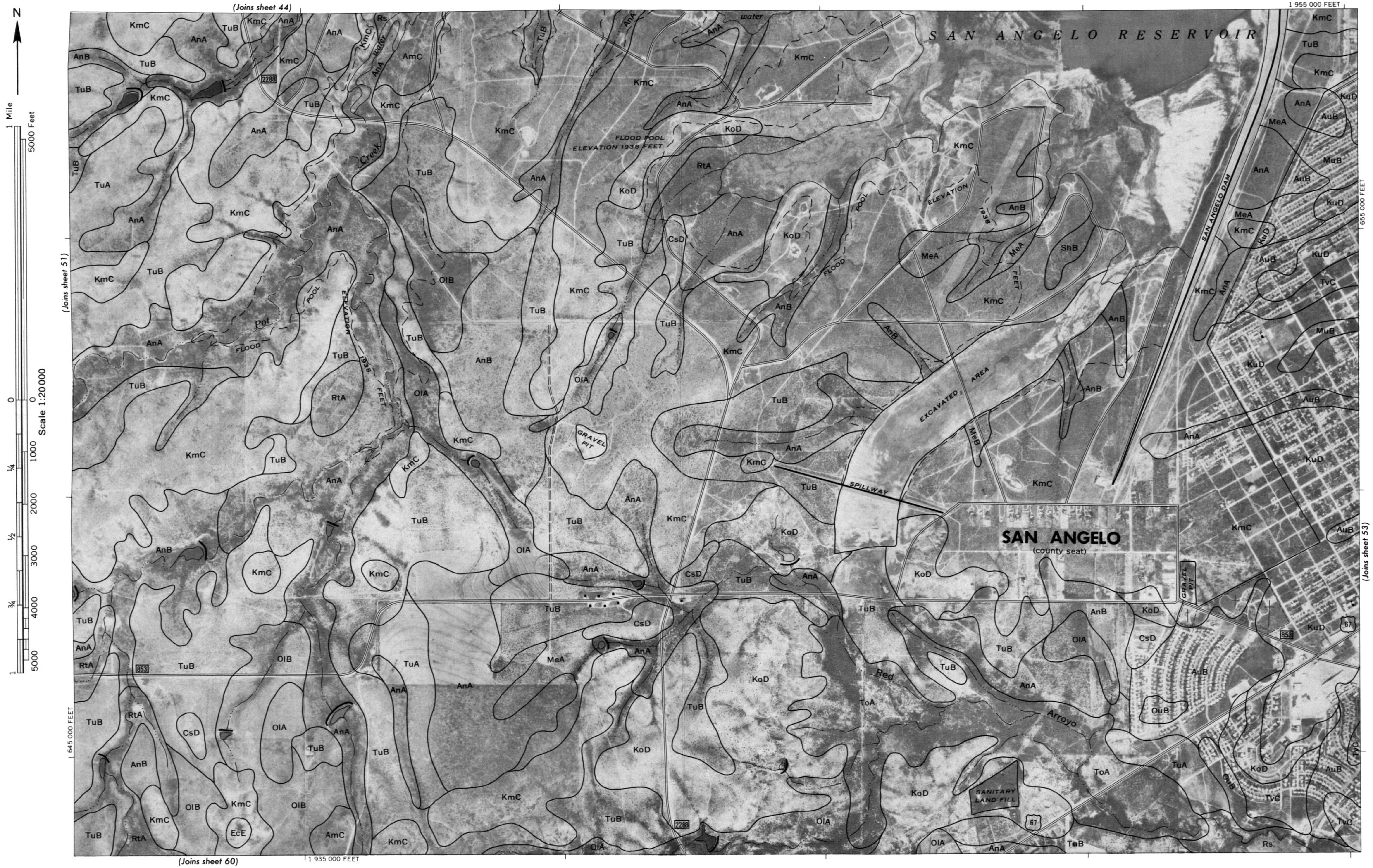
(Joins sheet 51)

(Joins sheet 58)

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.



This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.



Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 54

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

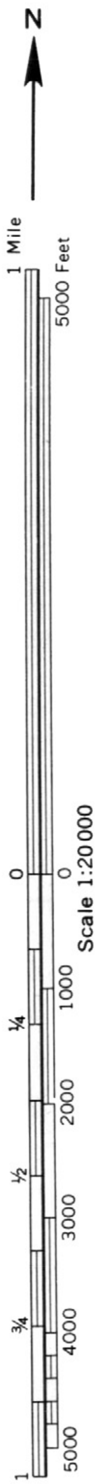
TOM GREEN COUNTY, TEXAS — SHEET NUMBER 55

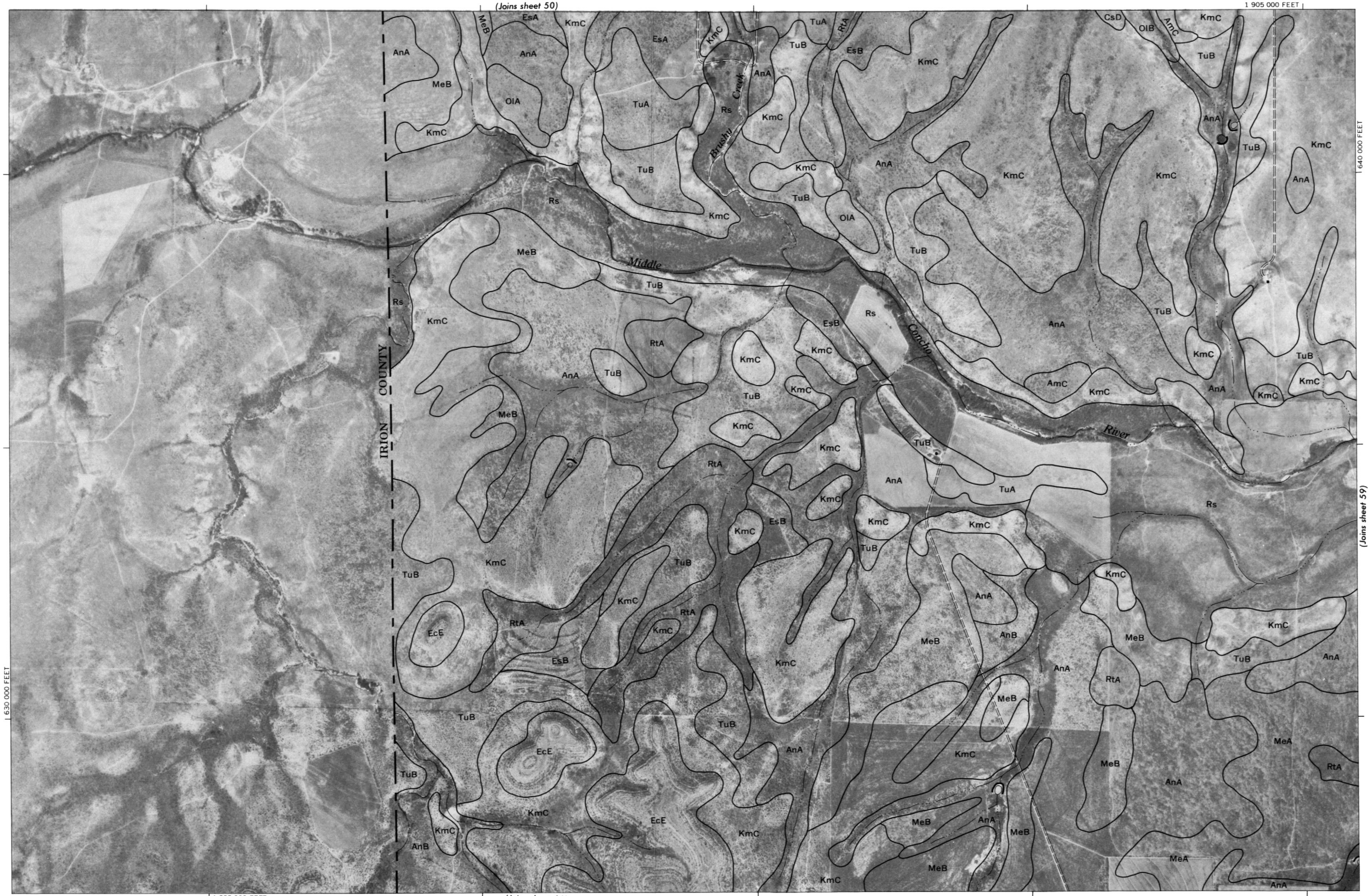
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 56

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.





Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

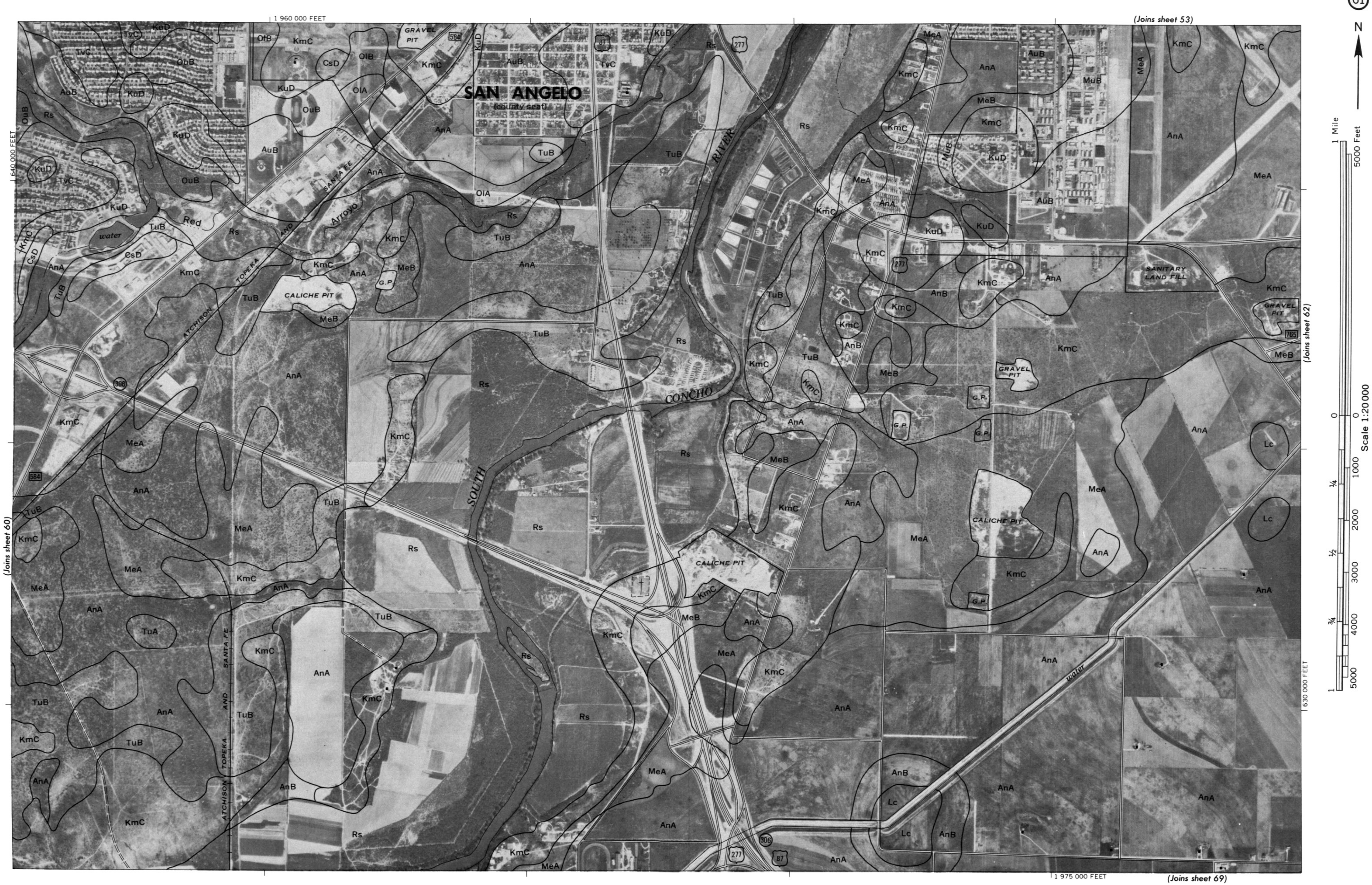
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 60

N

1 Mile
5000 Feet
0 0
Scale 1:20000
1000
¼
2000
½
3000
¾
4000
5000
1

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.



This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

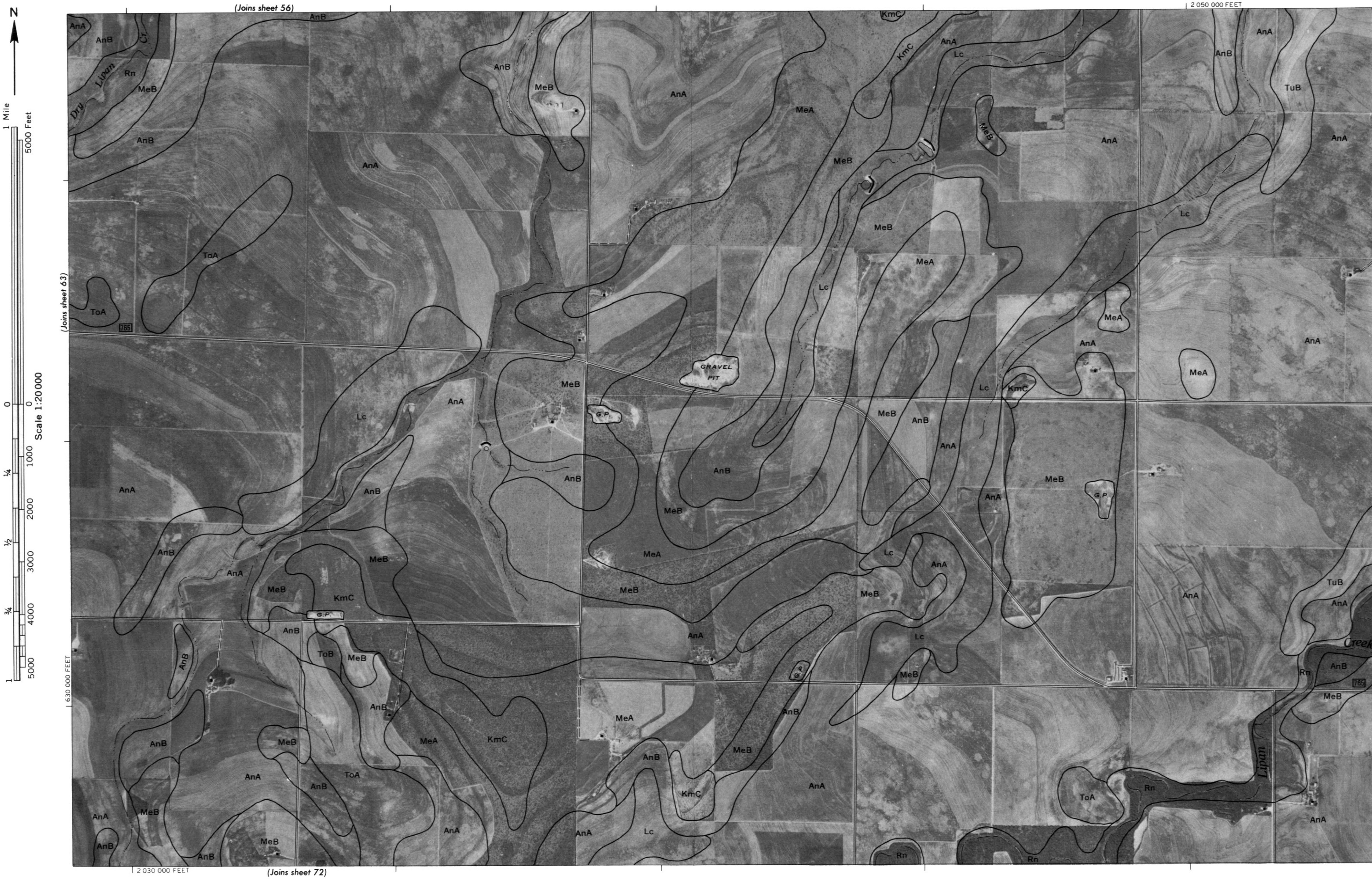
(62)

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 62

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 64



Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 66

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 68

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

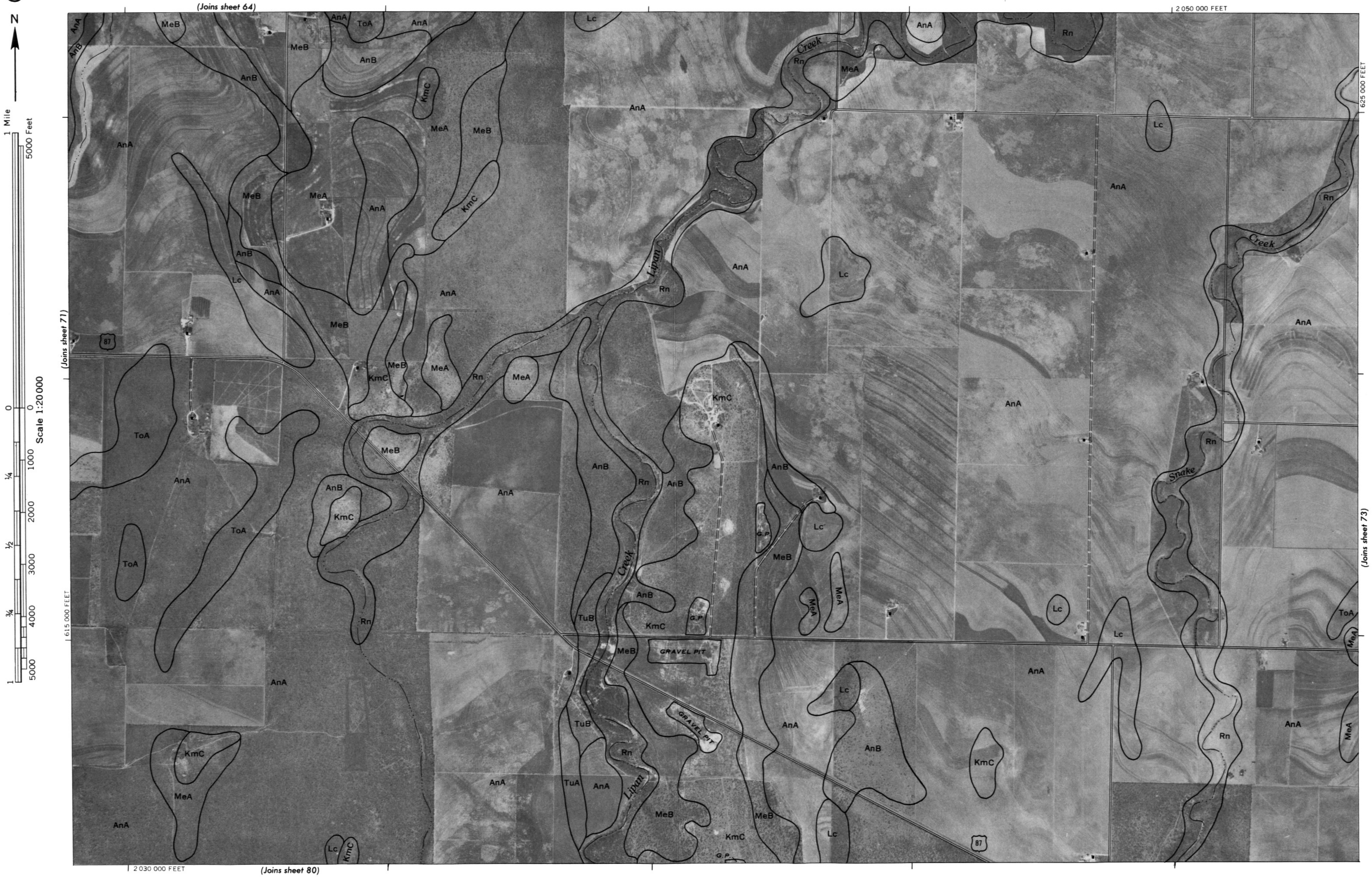
TOM GREEN COUNTY, TEXAS — SHEET NUMBER 70

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

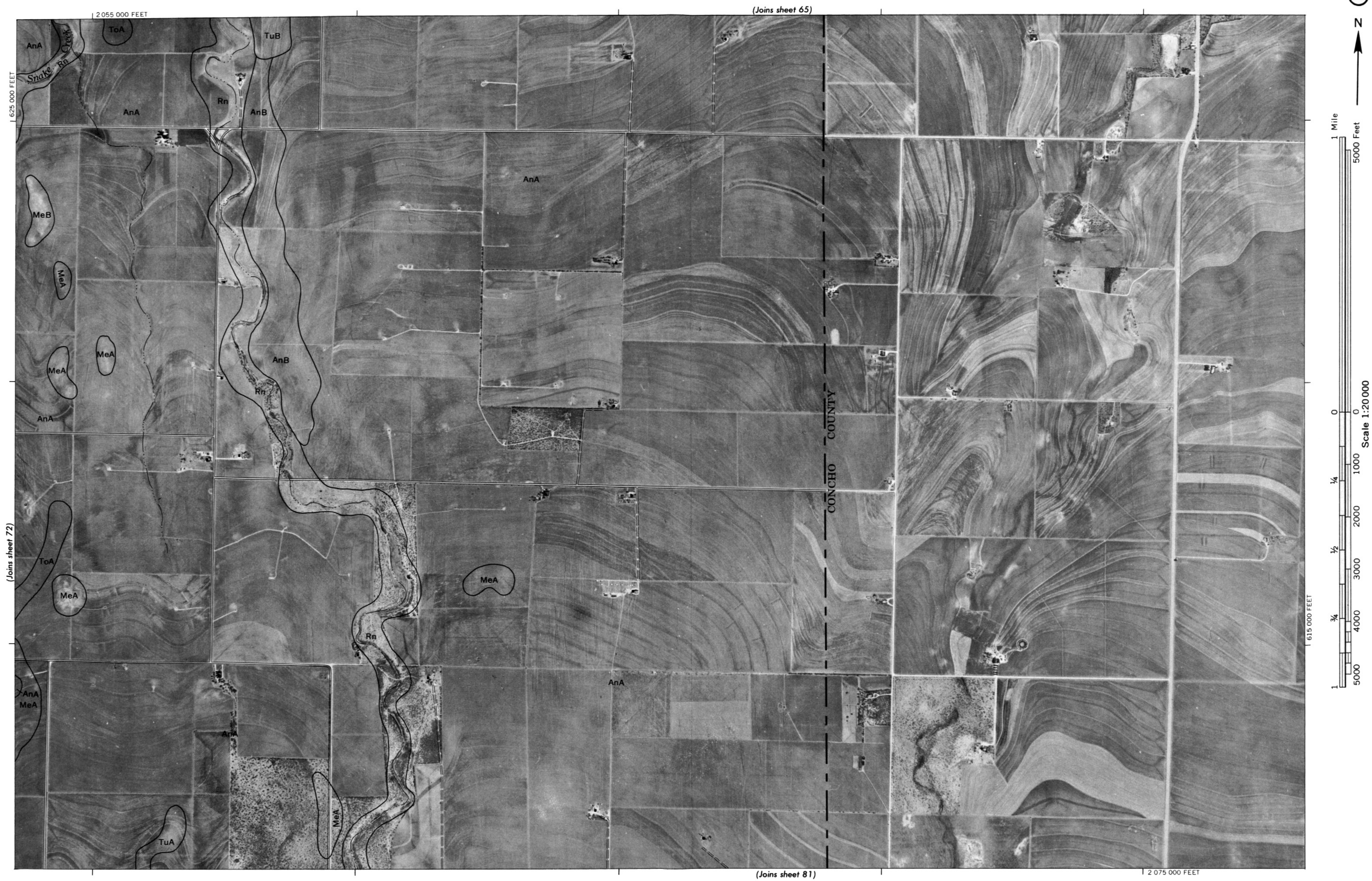
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 72



Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.



This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 74

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

75

N

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 76

Photobase from 1971 aerial photography. Positions of 5,000–foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 77

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000–foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 78

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

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Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 80

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 81

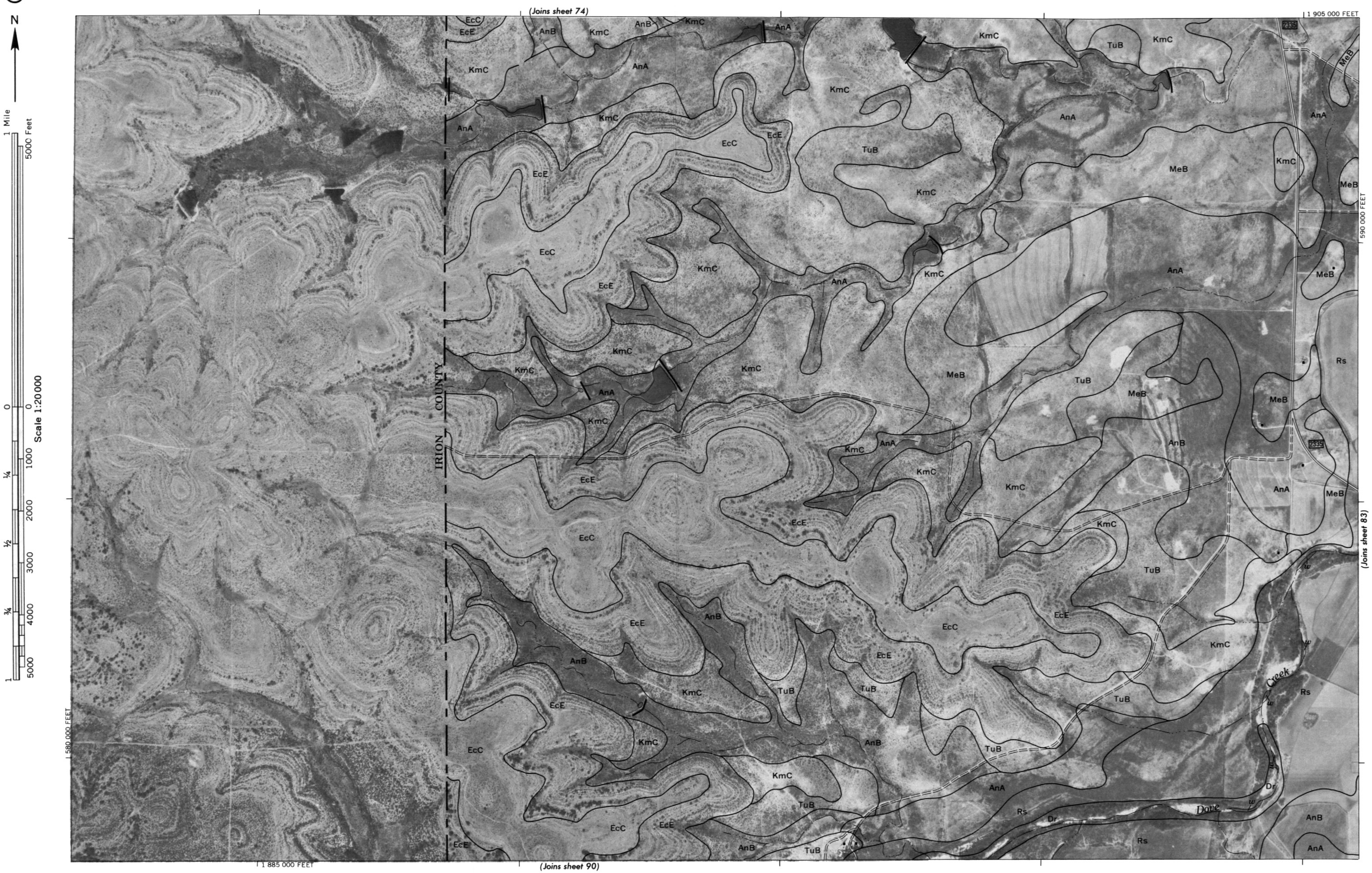
81

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

N

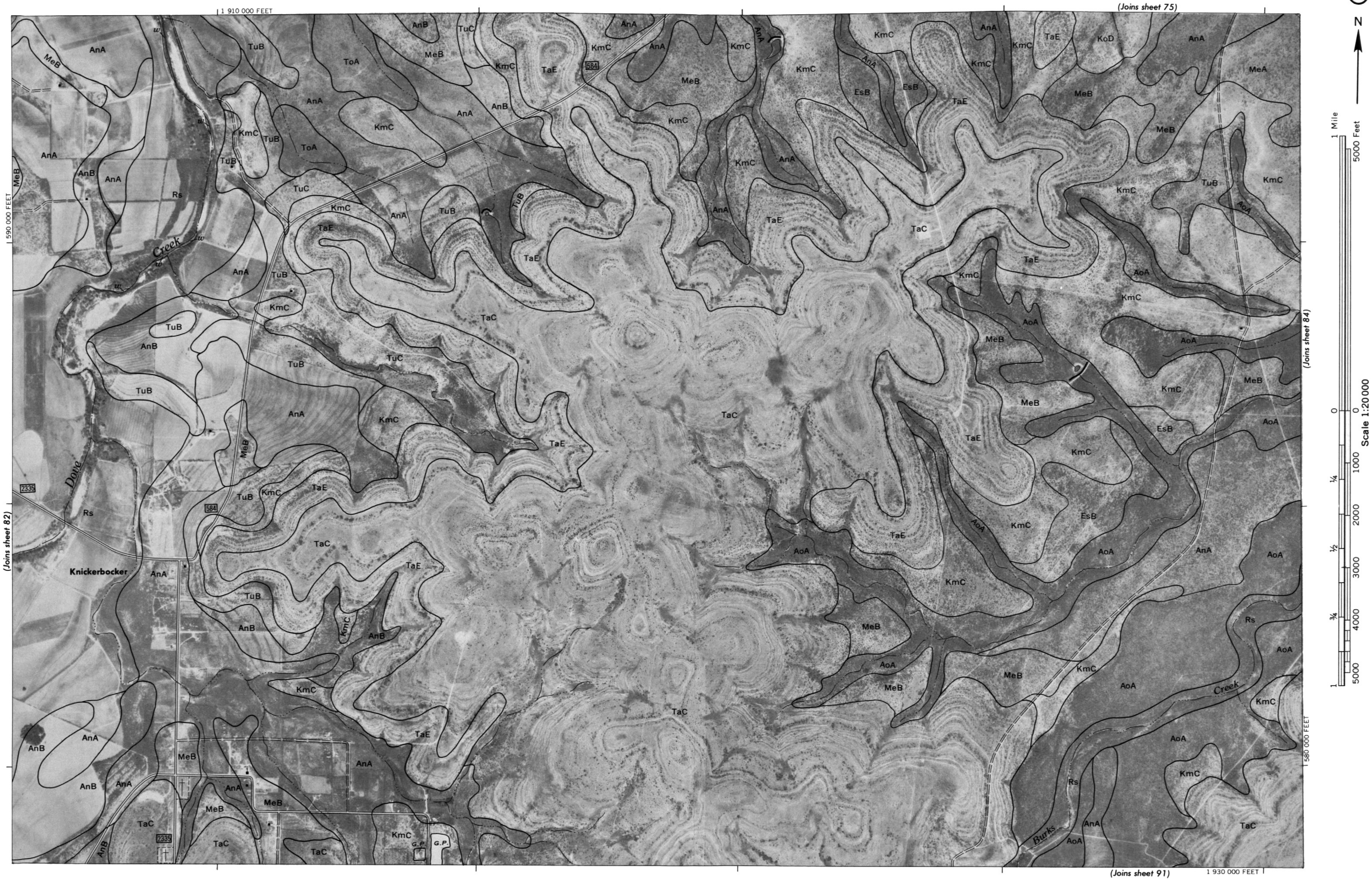
1 Mile
5000 Feet
0
¼
½
¾
1
0
1000
2000
3000
4000
5000
Scale 1:20 000

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 82



Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 83



This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000–foot grid ticks are approximate and based on the Texas coordinate system, central zone.

N

1 Mile

5000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 87

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 88

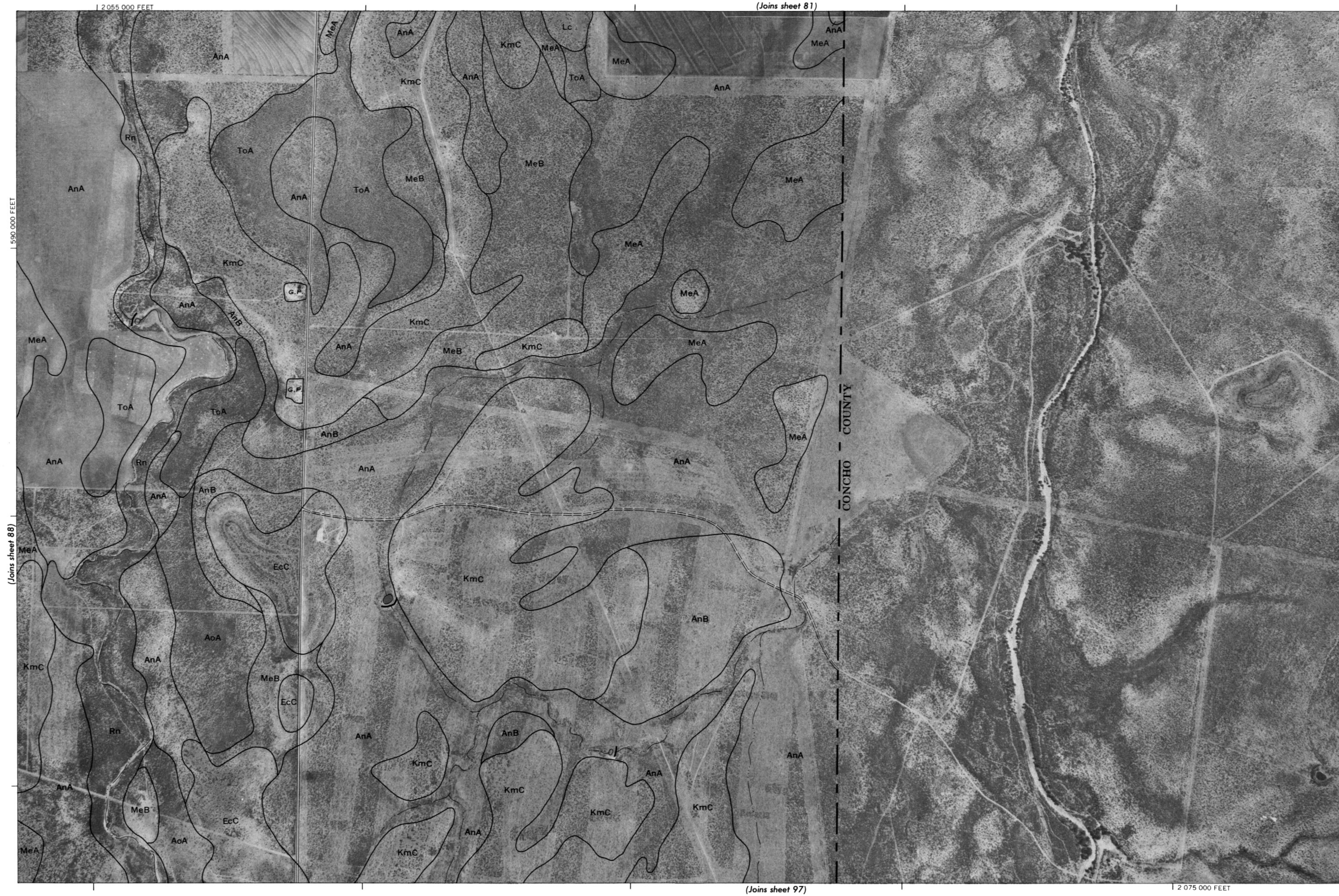
N

1 Mile
5000 Feet
0
¼
½
¾
1
0
1000
2000
3000
4000
5000
Scale 1:20000

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.



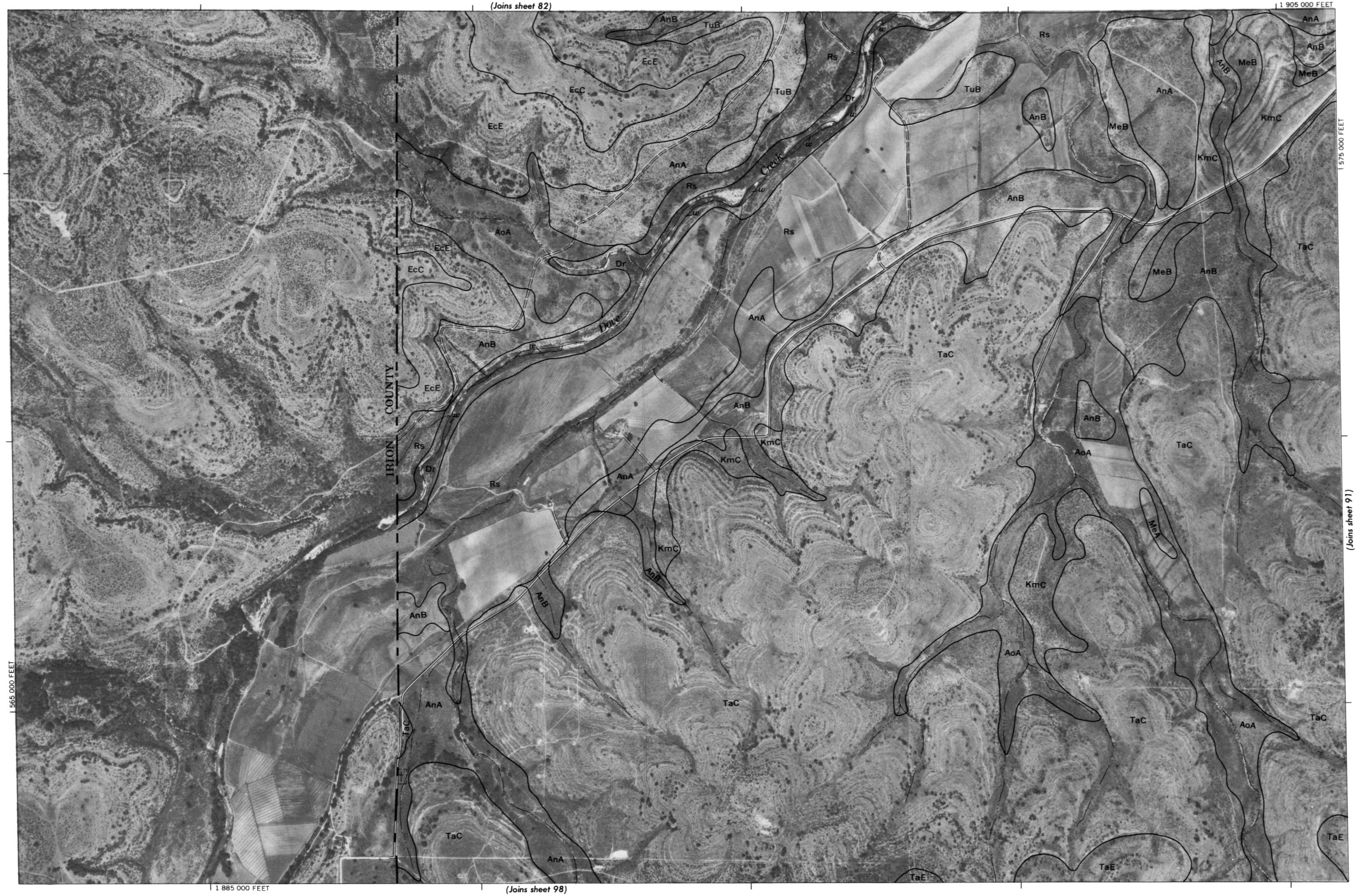
N

1 Mile
5000 Feet
Scale 1:20 000
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 90

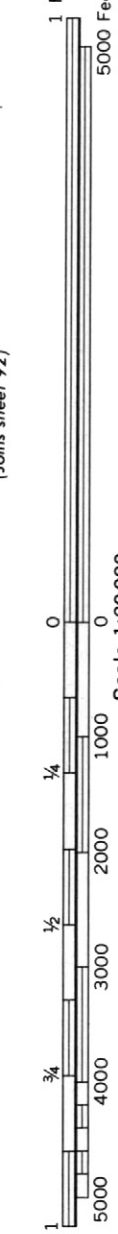
N

1 Mile
5000 Feet
Scale 1:20000
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000



Photobase from 1971 aerial photography. Positions of 5,000–foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

N



Scale 1:20 000

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

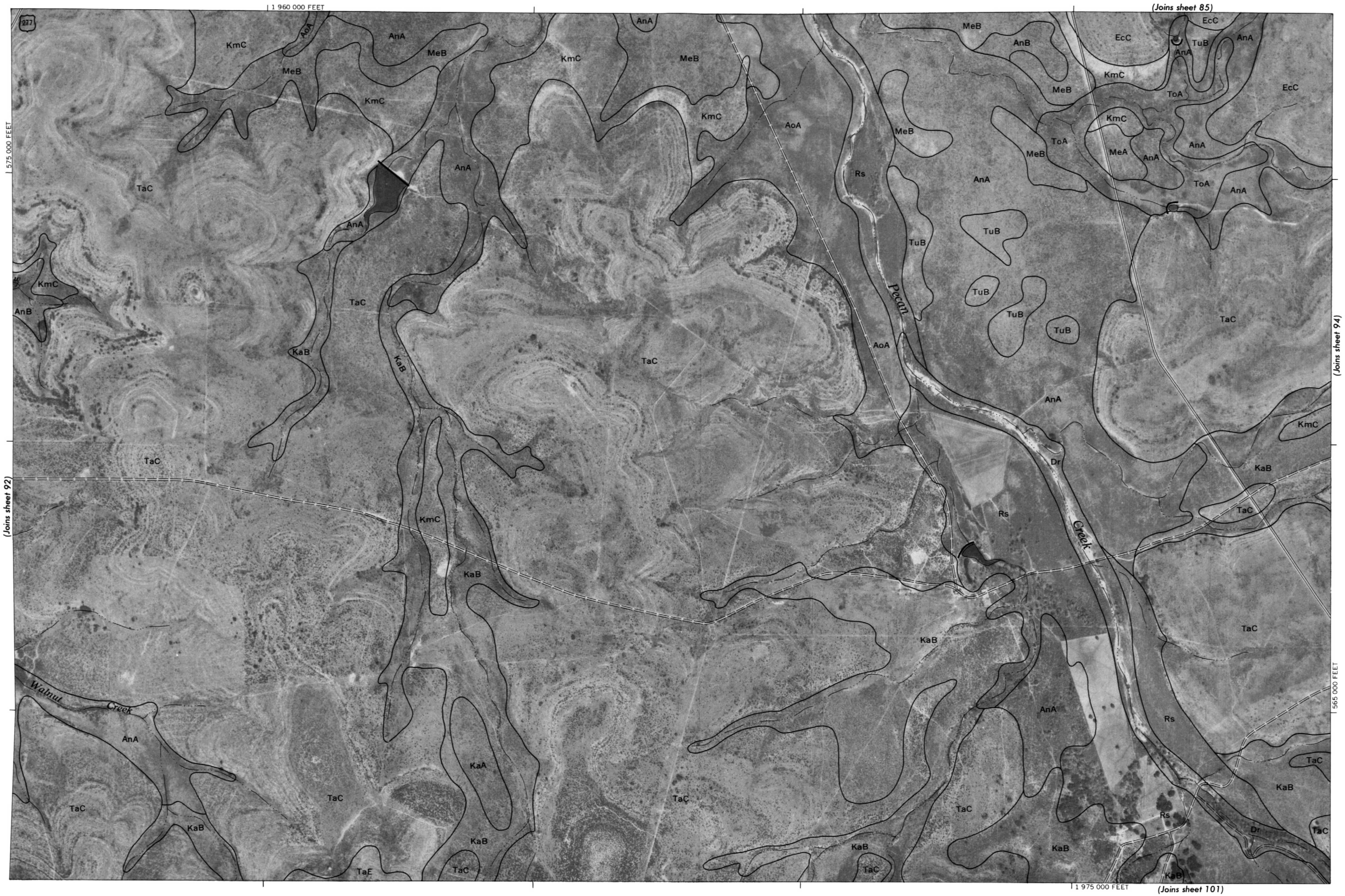
92

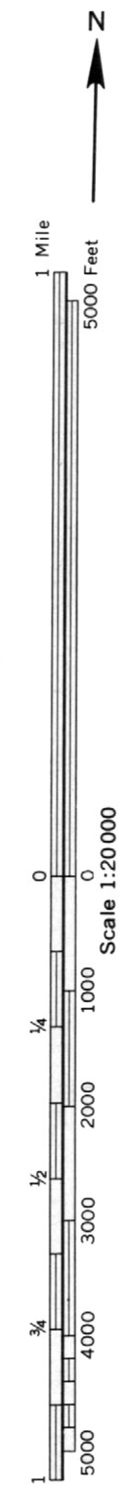
TOM GREEN COUNTY, TEXAS — SHEET NUMBER 92

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 93

93





This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000–foot grid ticks are approximate and based on the Texas coordinate system, central zone.

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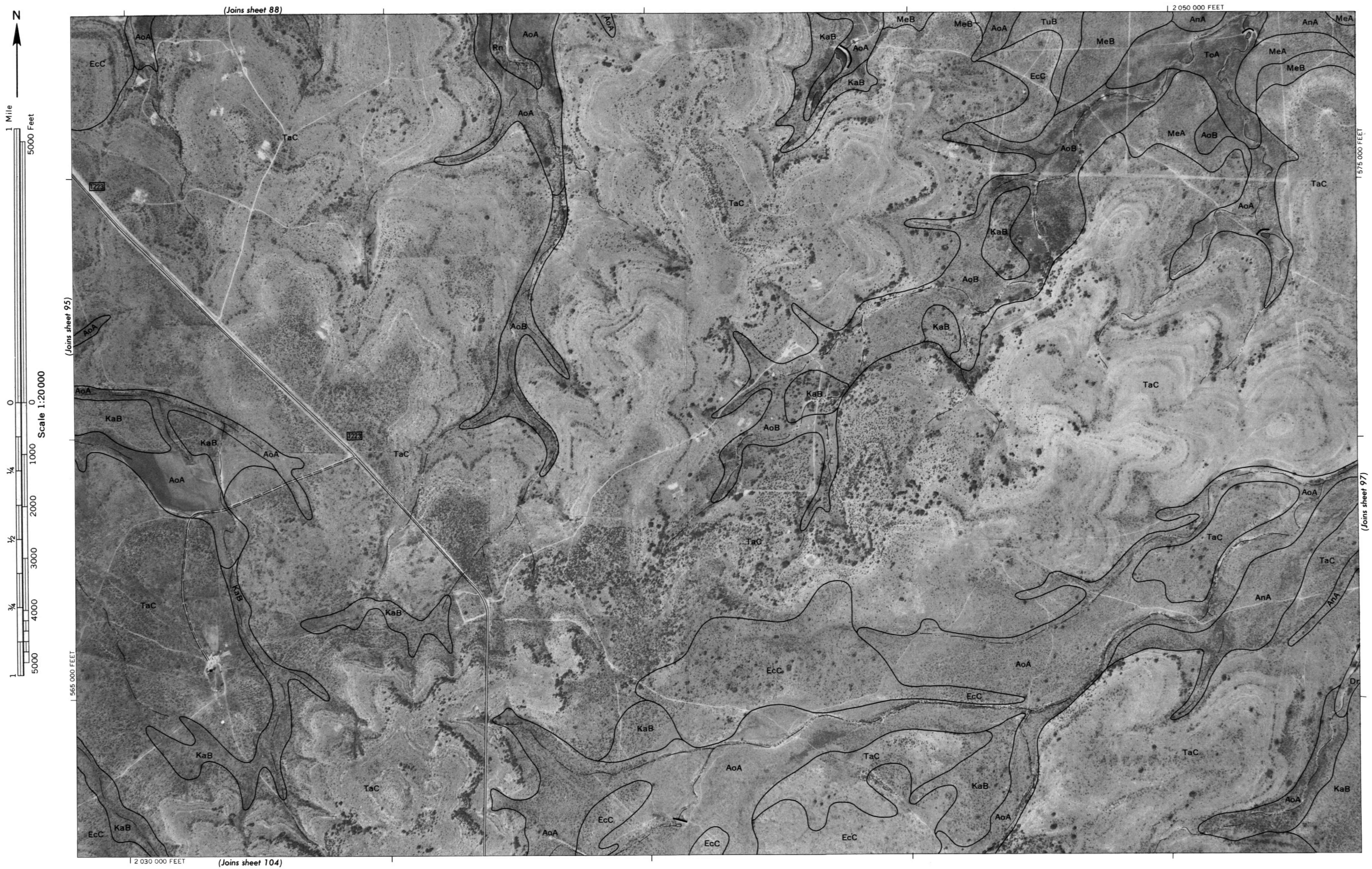
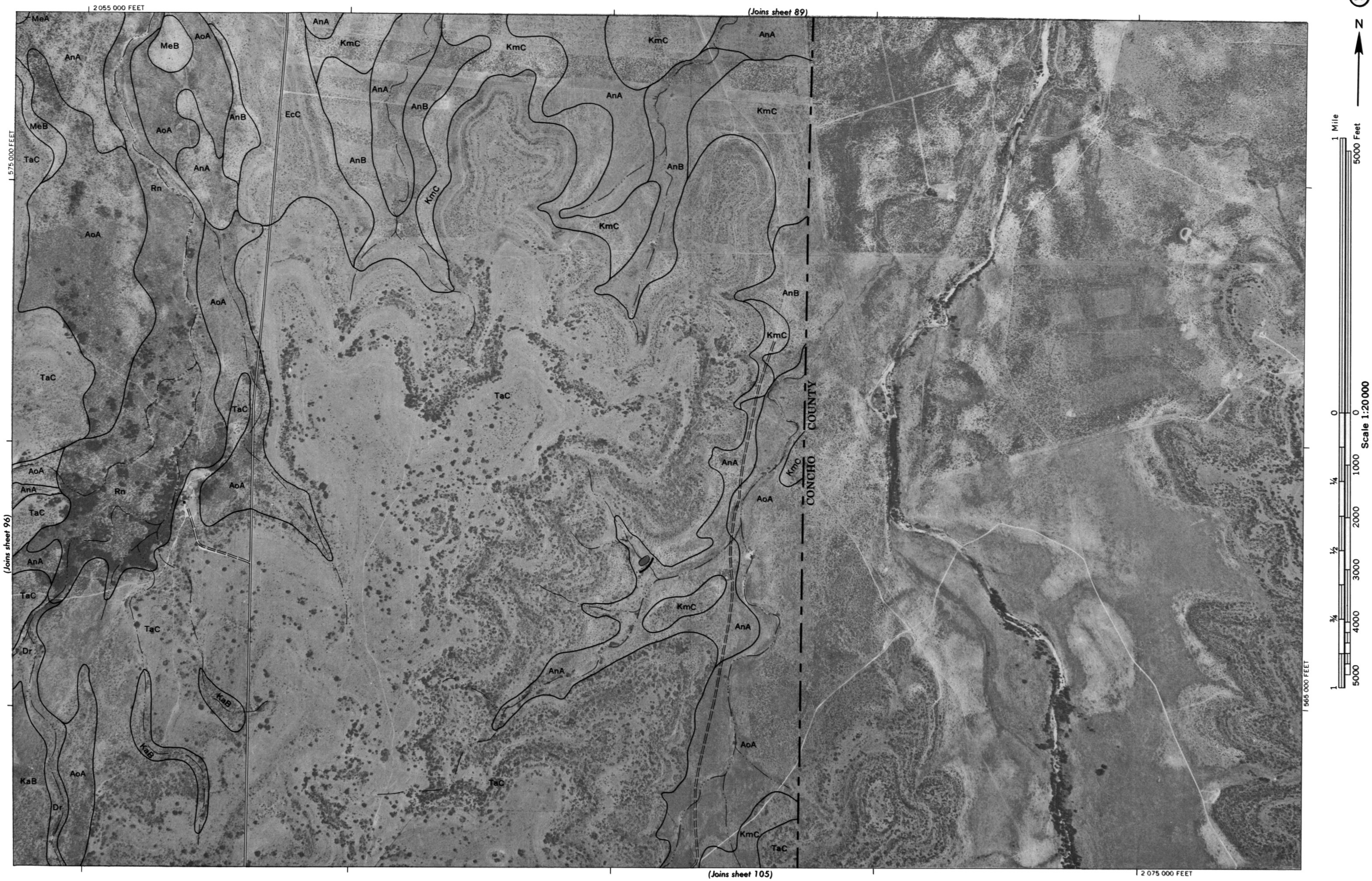
TOM GREEN COUNTY, TEXAS — SHEET NUMBER 95

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 96



Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

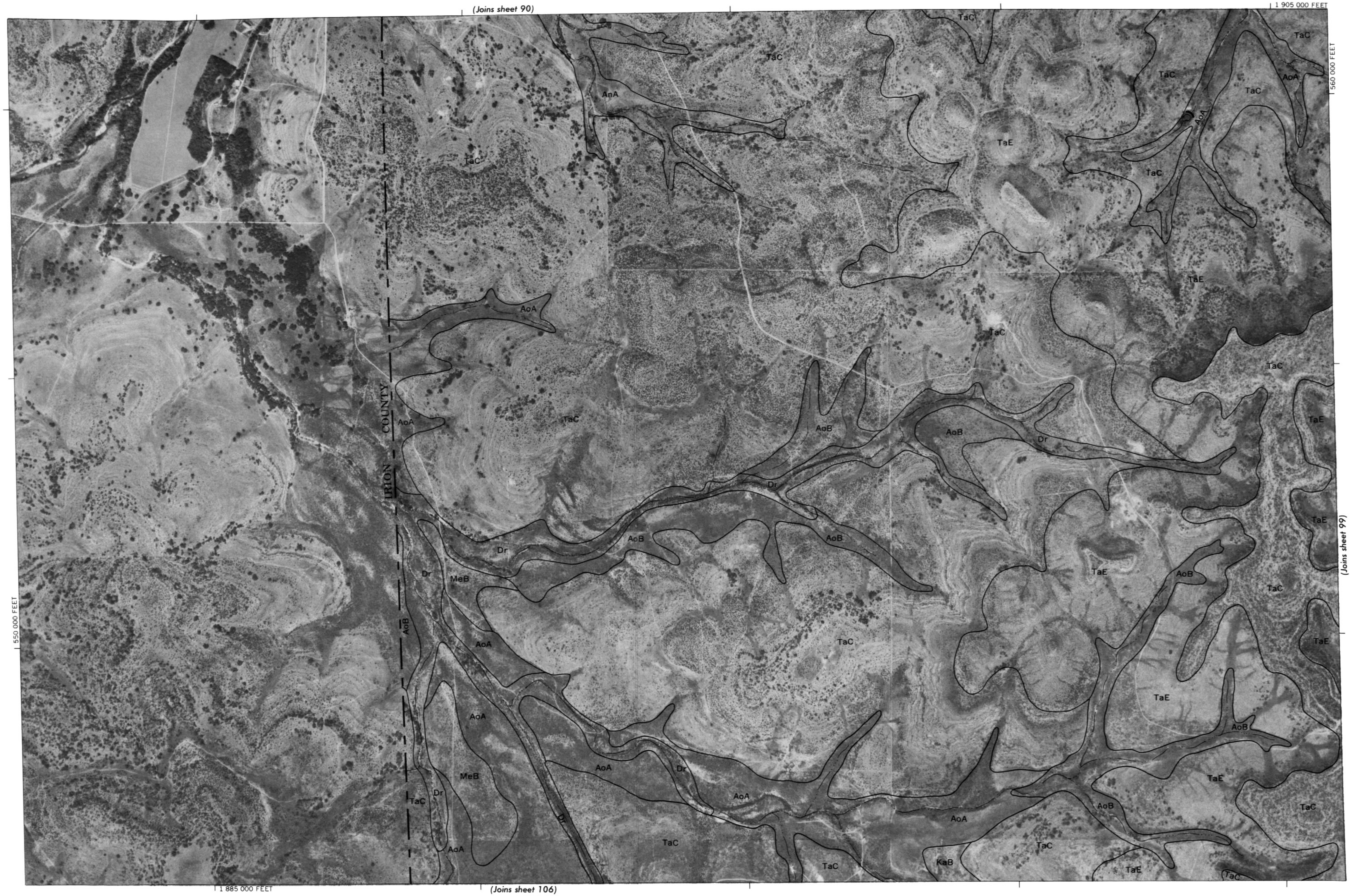


This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 98

N

1 Mile
5000 Feet
Scale 1:20 000



Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
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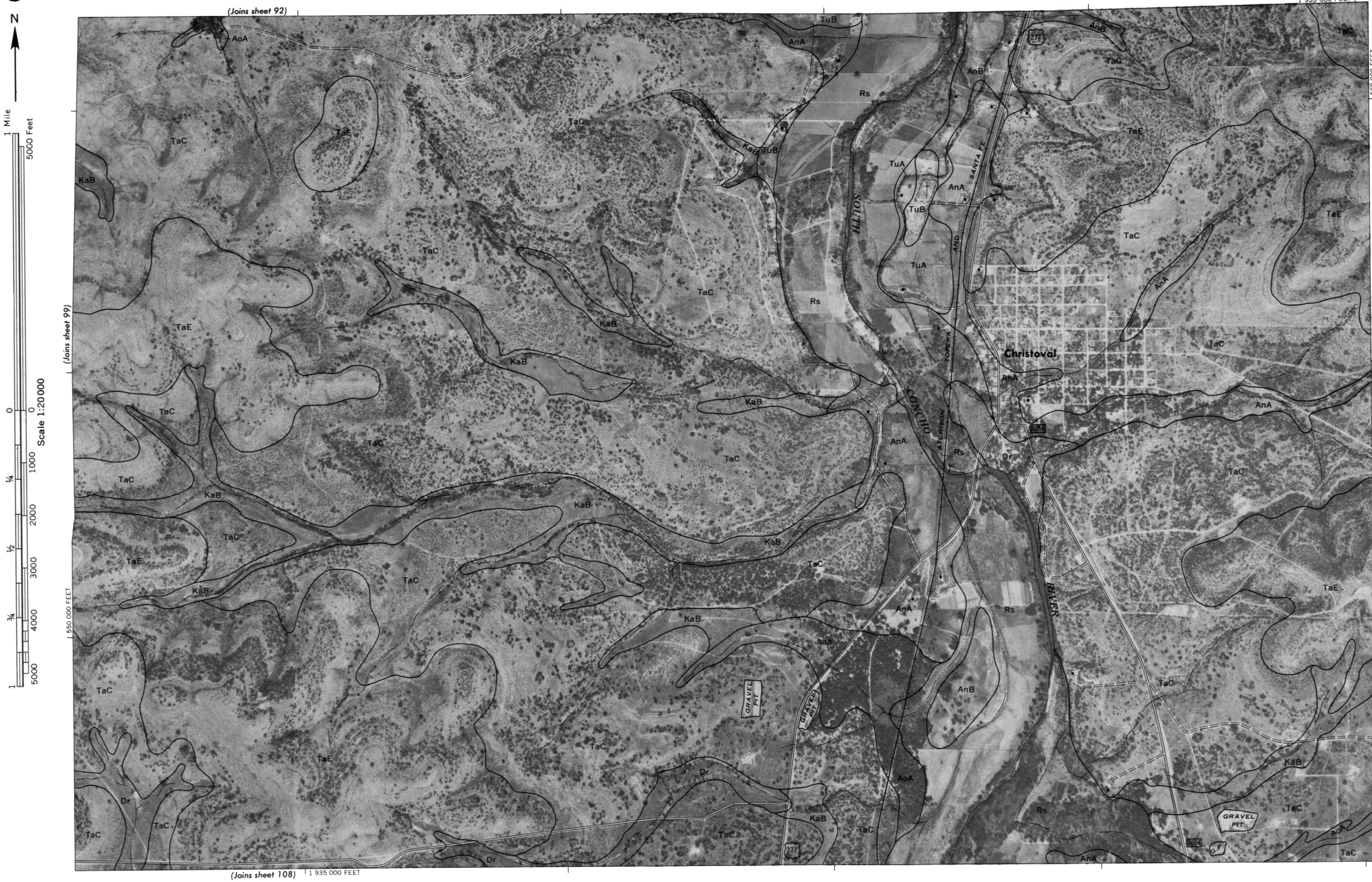
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 100



Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
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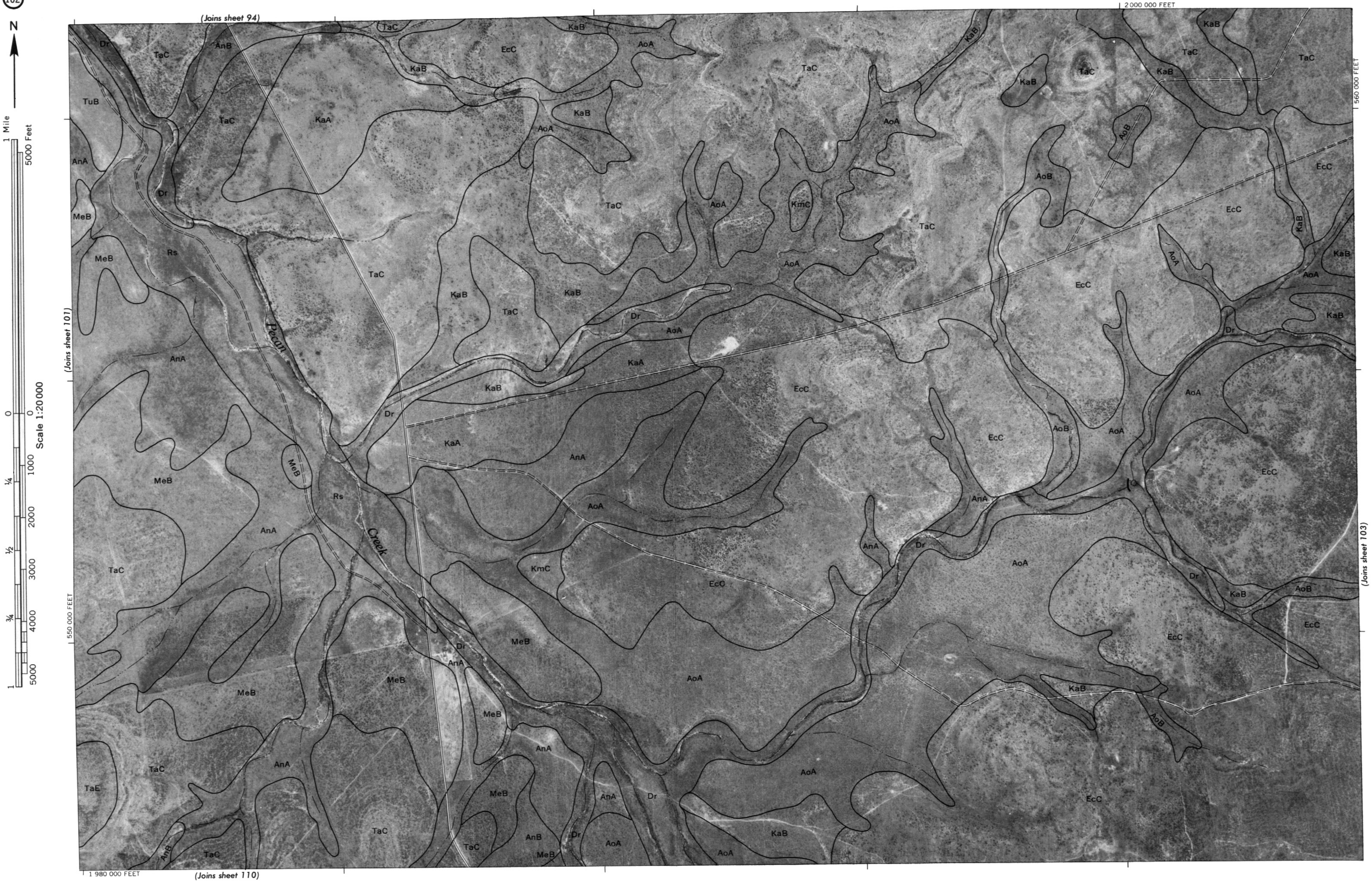
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 102



Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 103

103

N

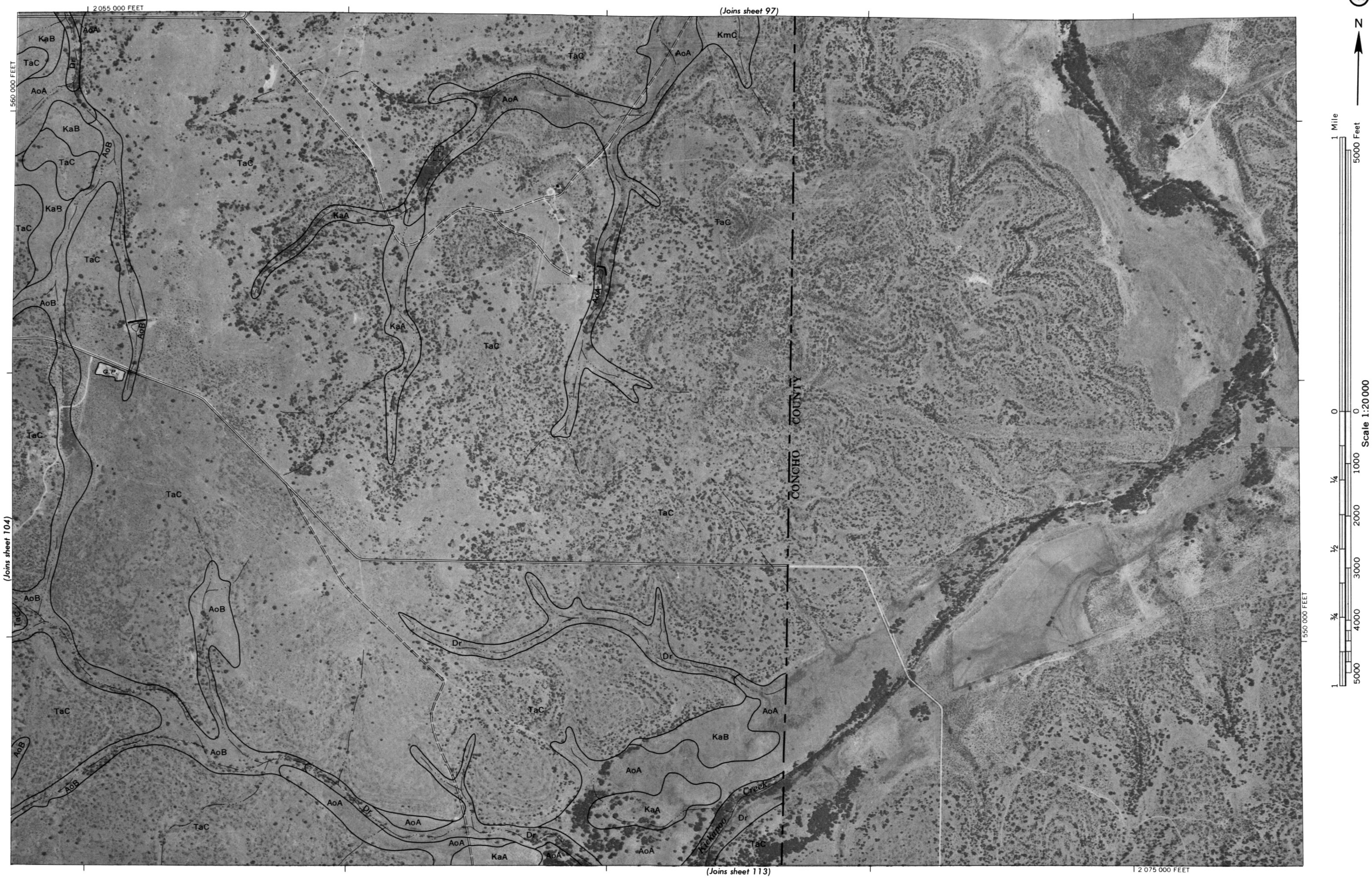
Scale 1:20 000

1 Mile | 5000 Feet

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

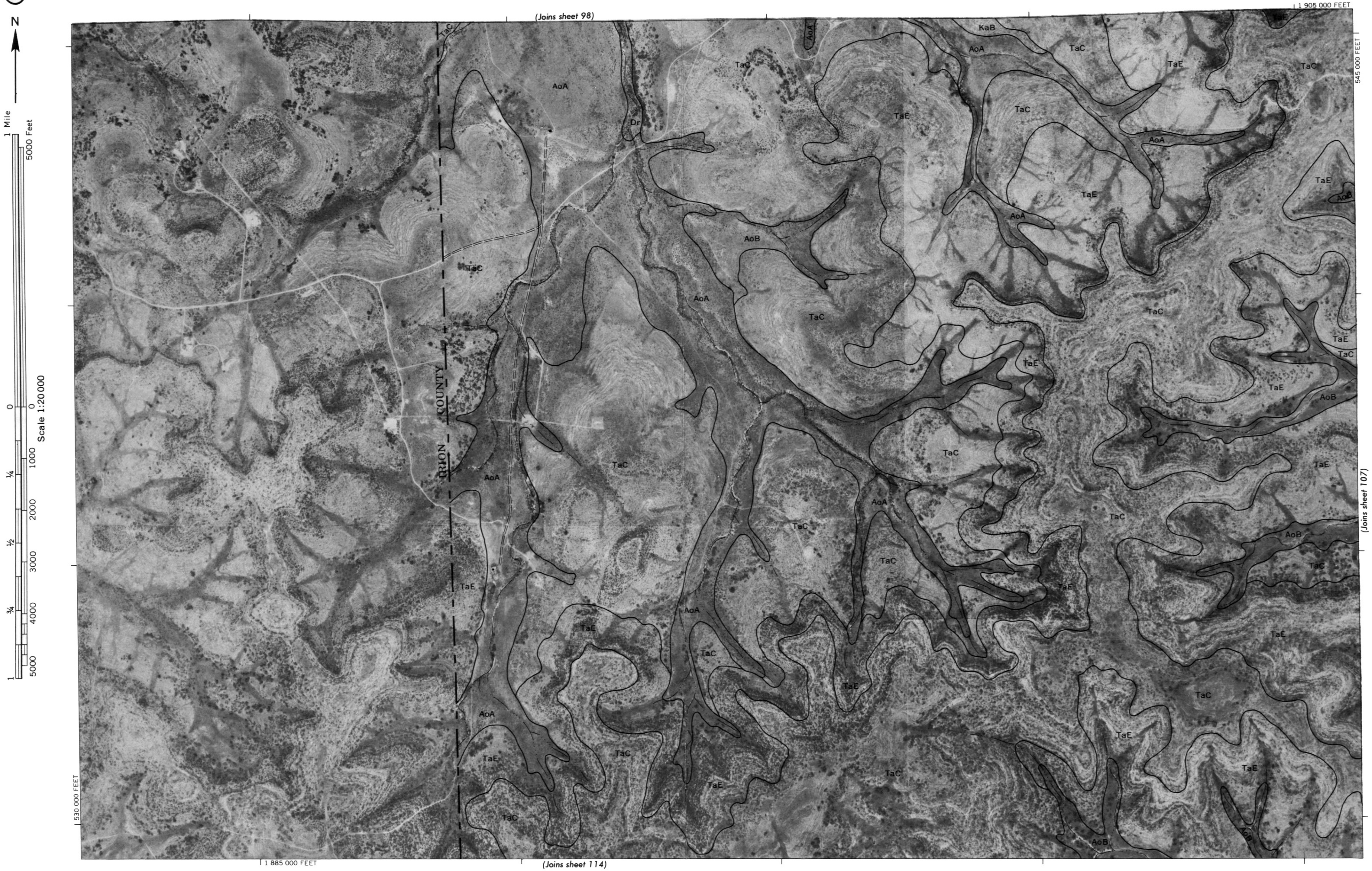
TOM GREEN COUNTY, TEXAS — SHEET NUMBER 104

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

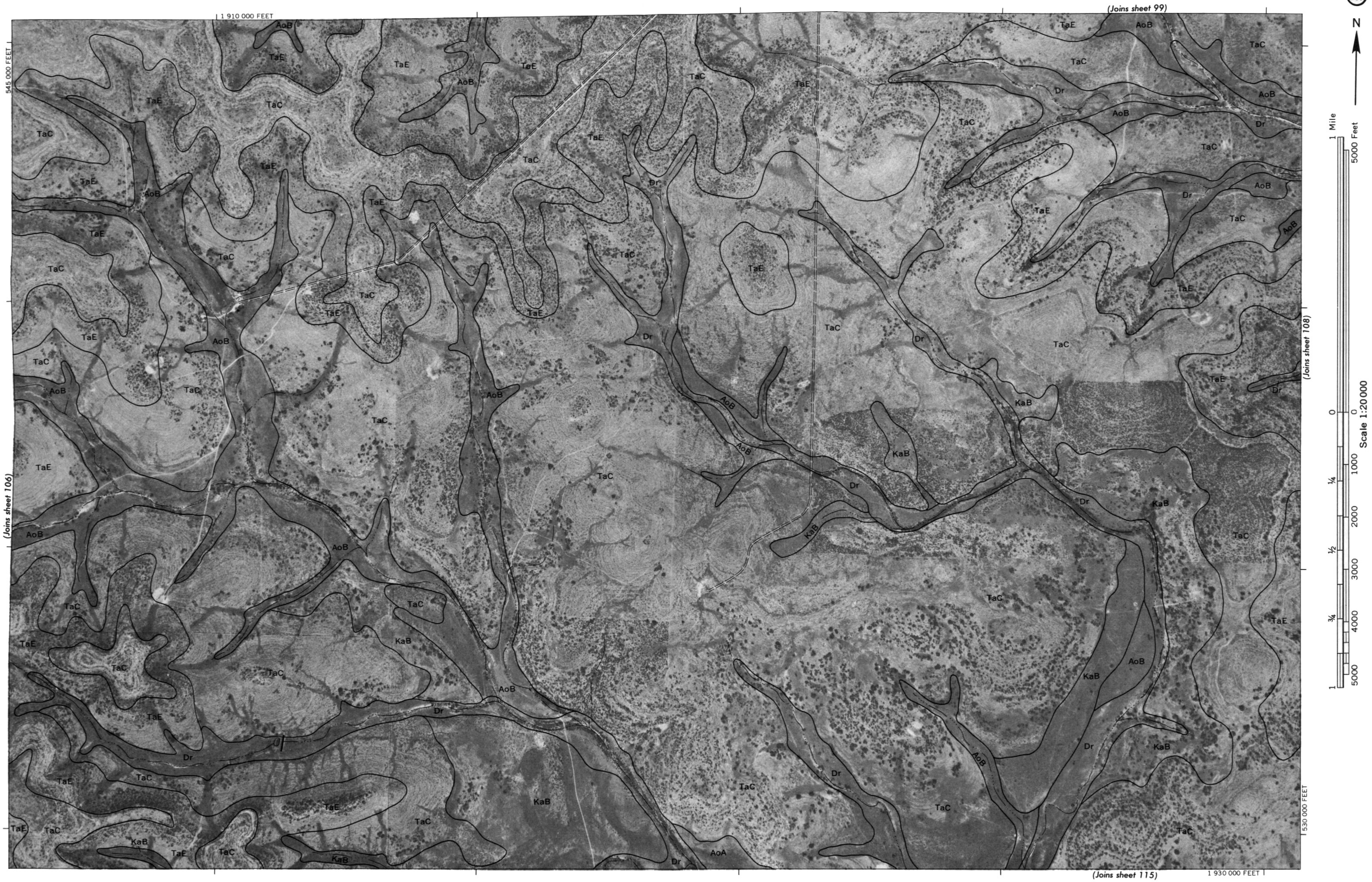


This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 106

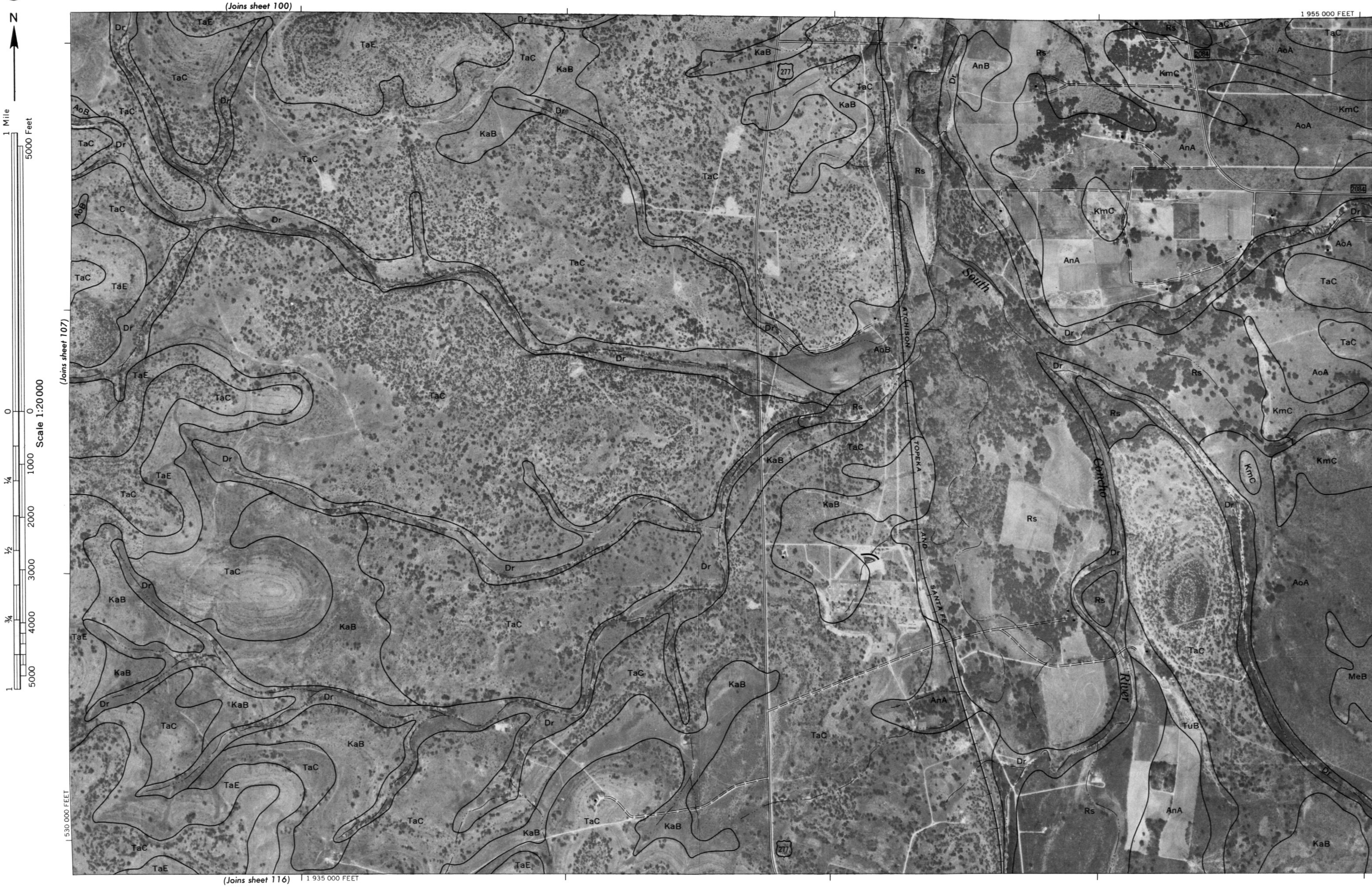


Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.



This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 108



Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

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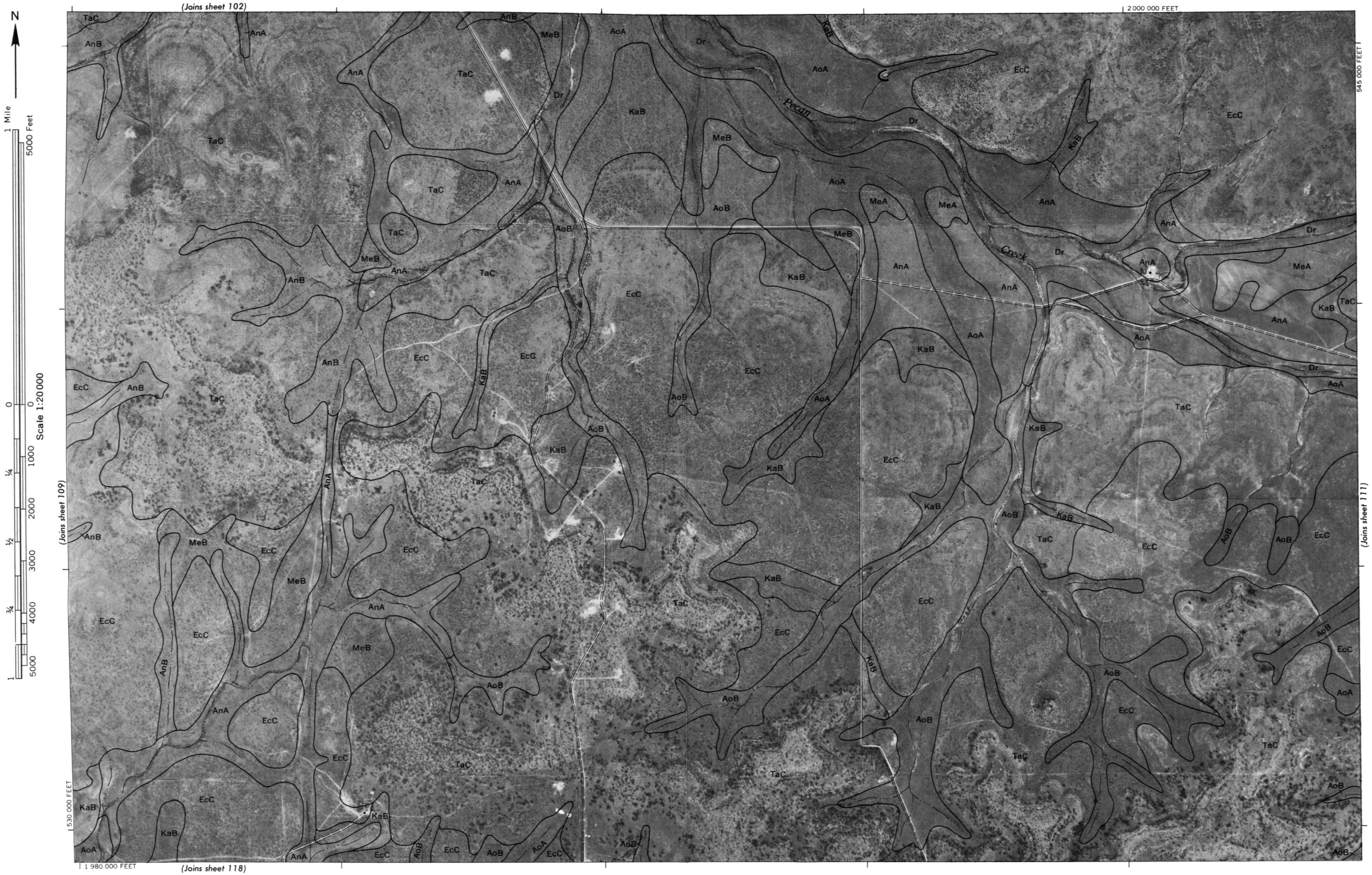
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

110

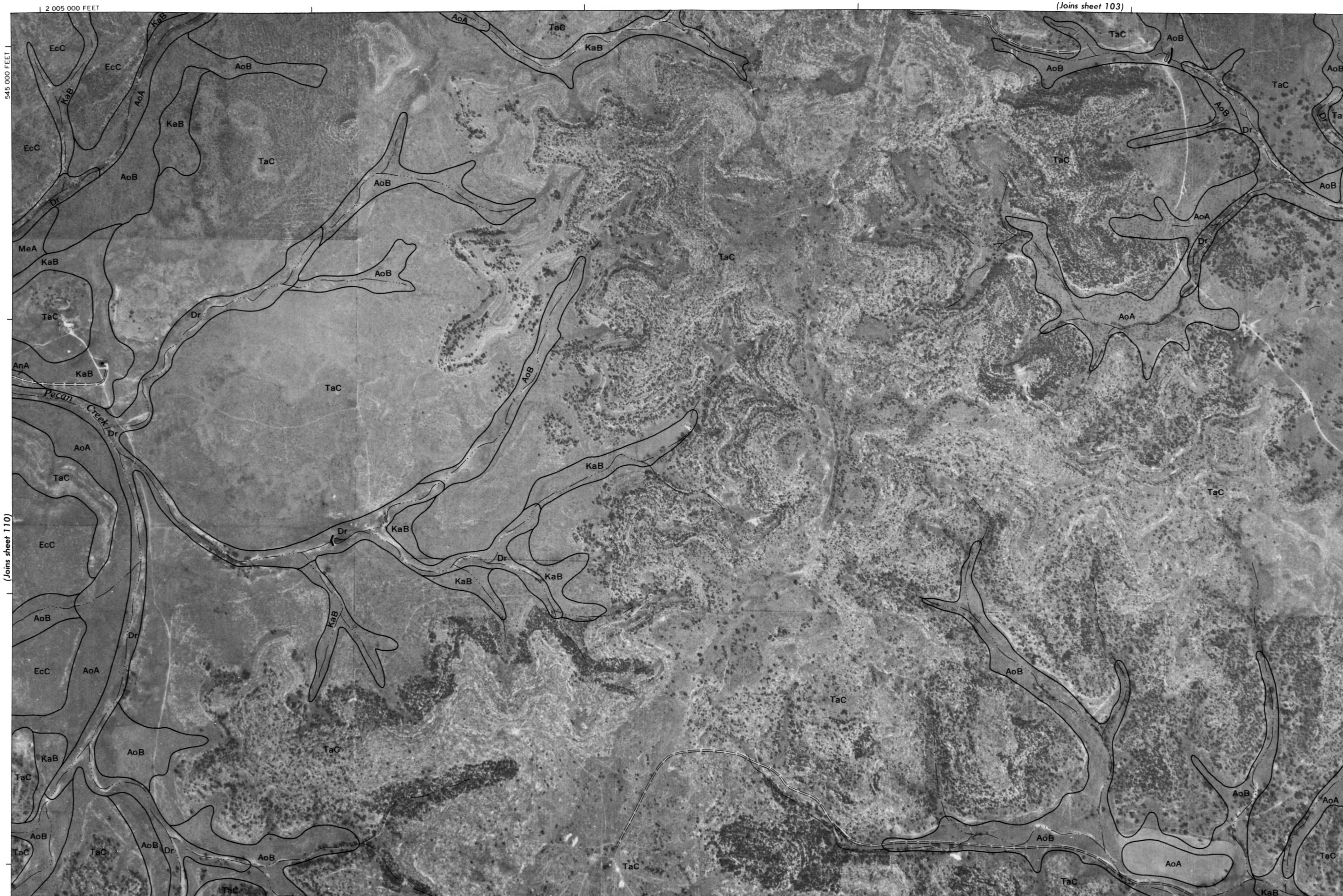
TOM GREEN COUNTY, TEXAS — SHEET NUMBER 110



Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 111

111



N

1 Mile

5000 Feet

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

Scale 1:20 000

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

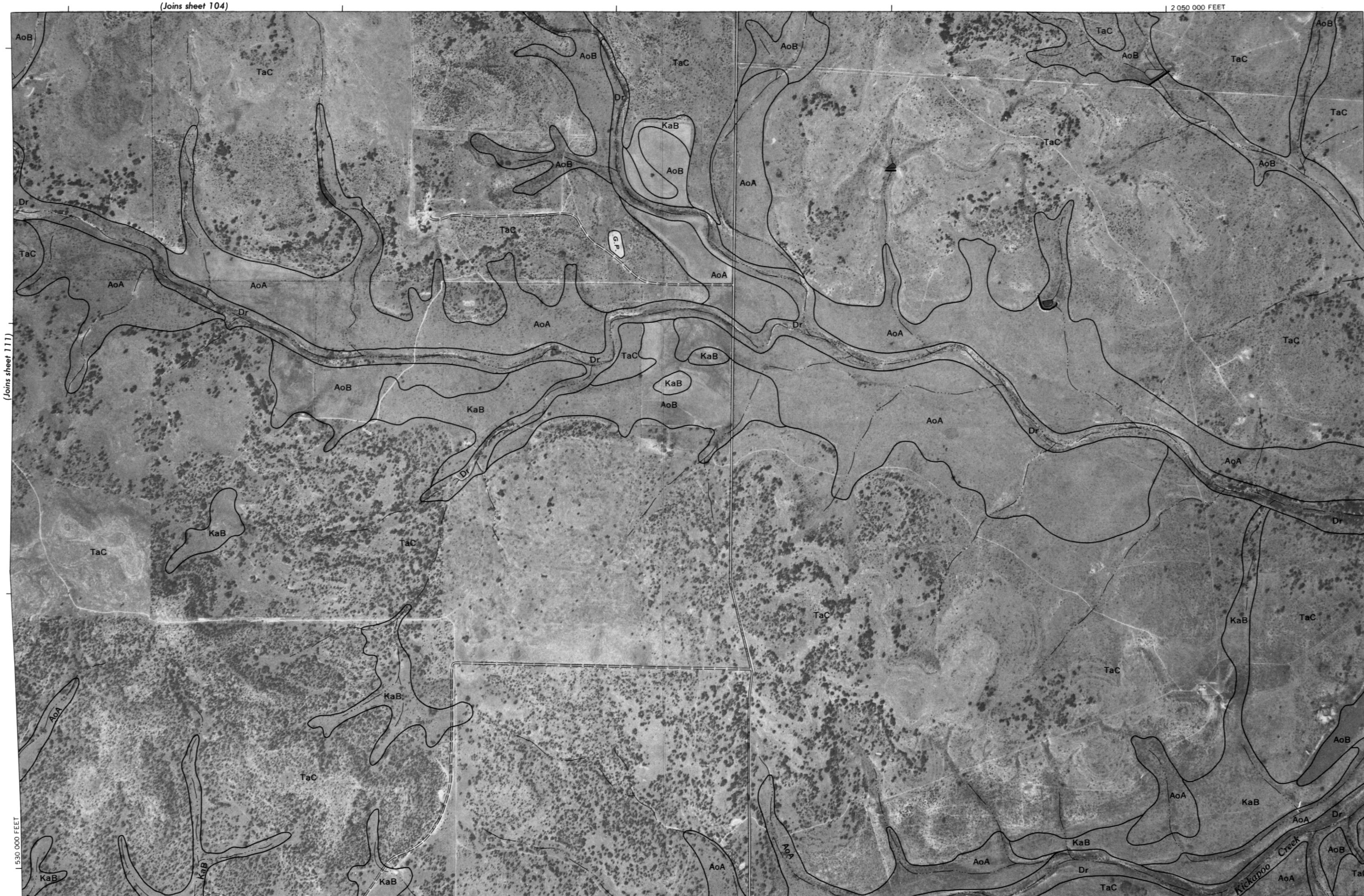
N

1 Mile
5000 Feet

Scale 1:20 000

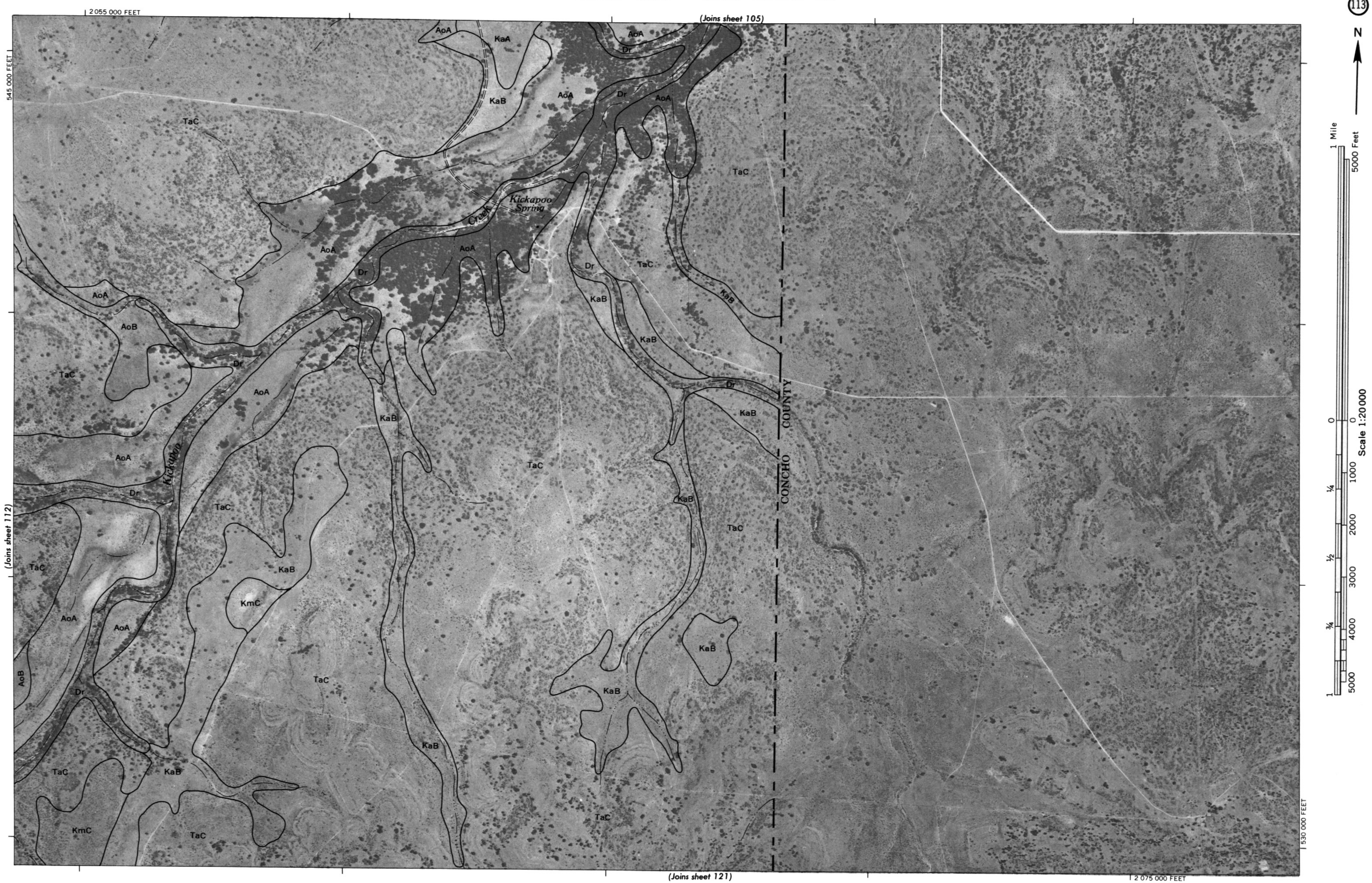
0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000



Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

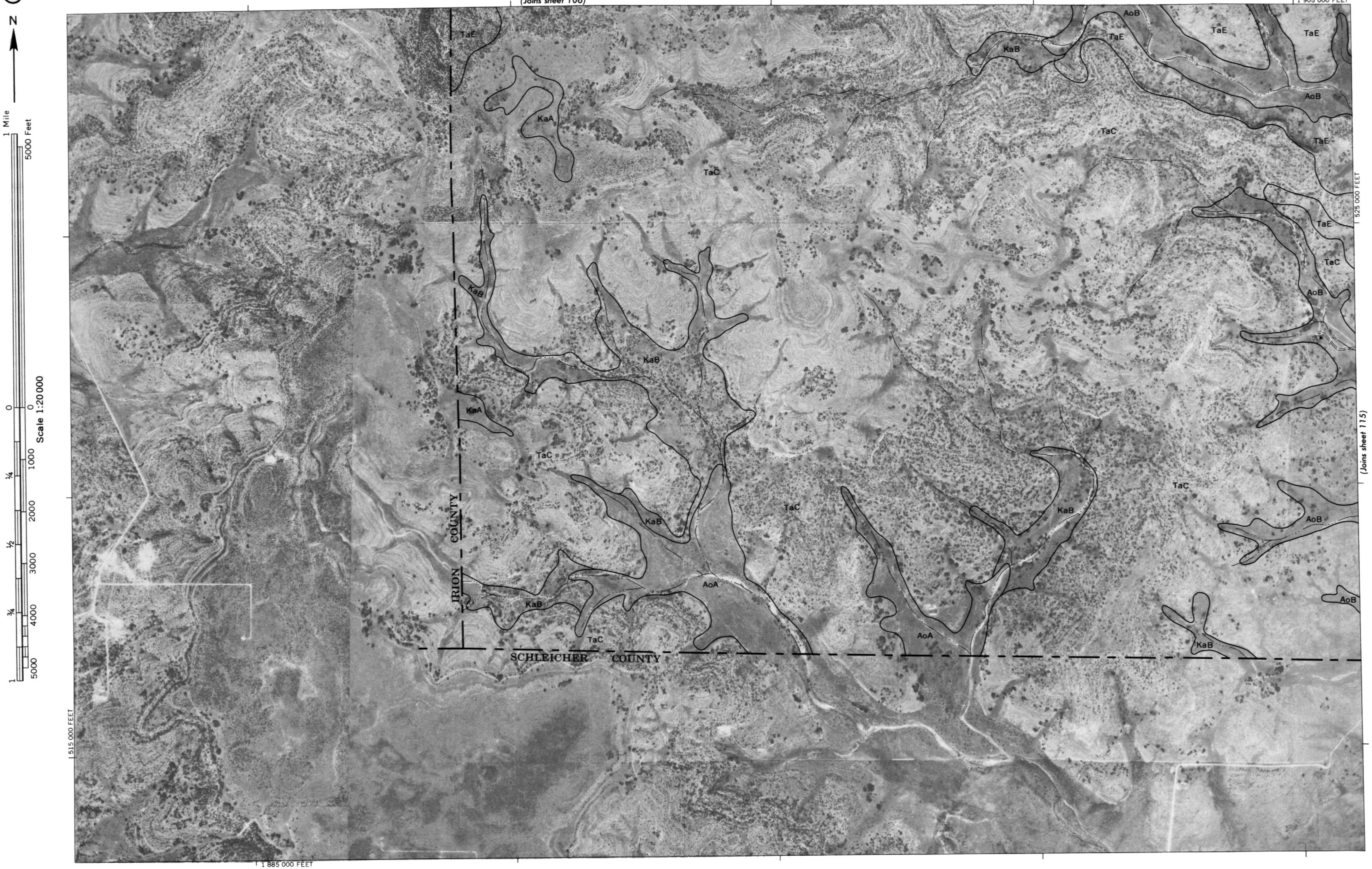
TOM GREEN COUNTY, TEXAS — SHEET NUMBER 113



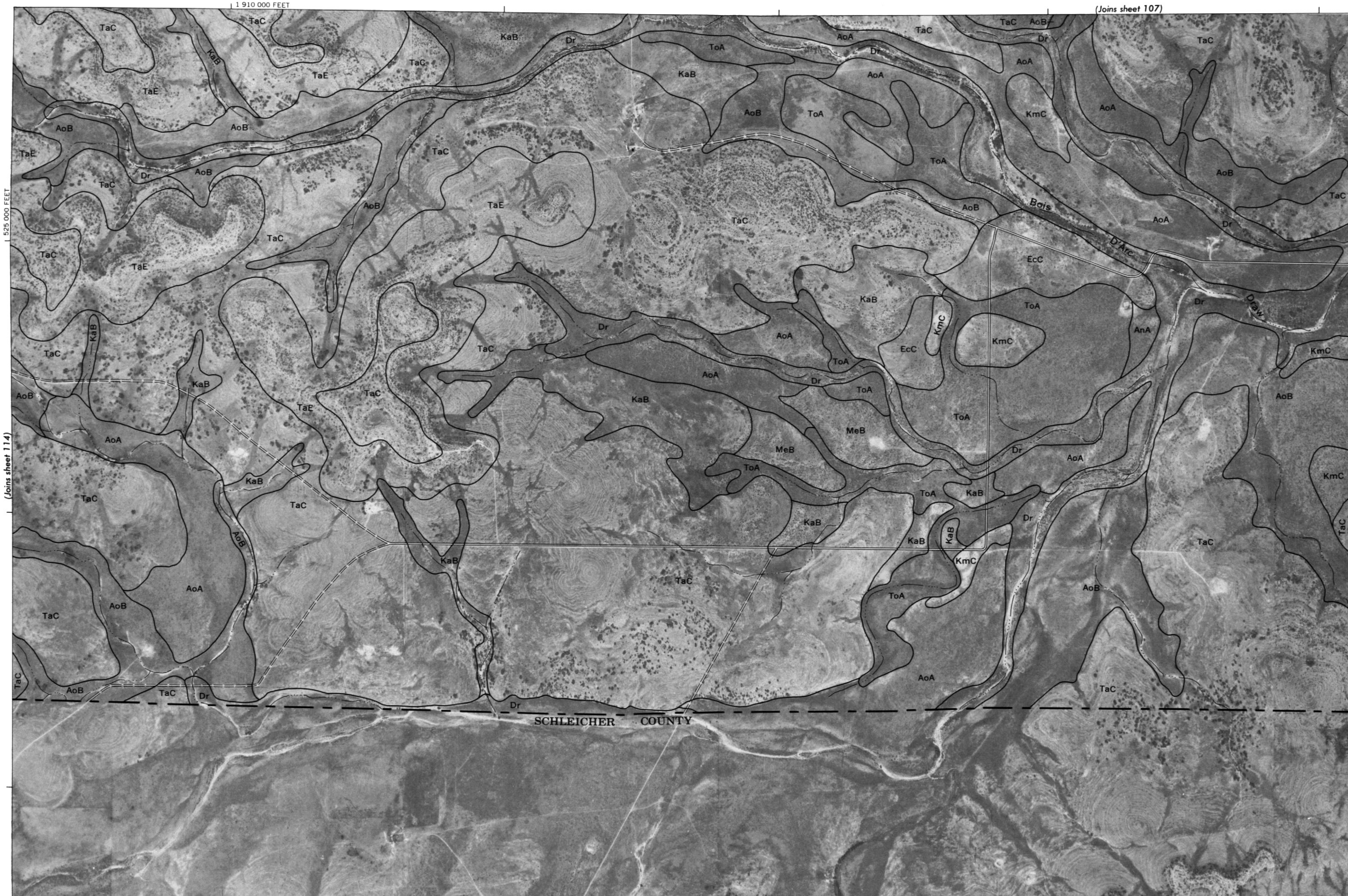
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

114

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 114



Photobase from 1971 aerial photography. Positions of 5,000–foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.



N

1 Mile
5000 Feet

0	0
	1000
1/4	
	2000
1/2	
	3000
3/4	4000
1	5000

Scale 1:20000

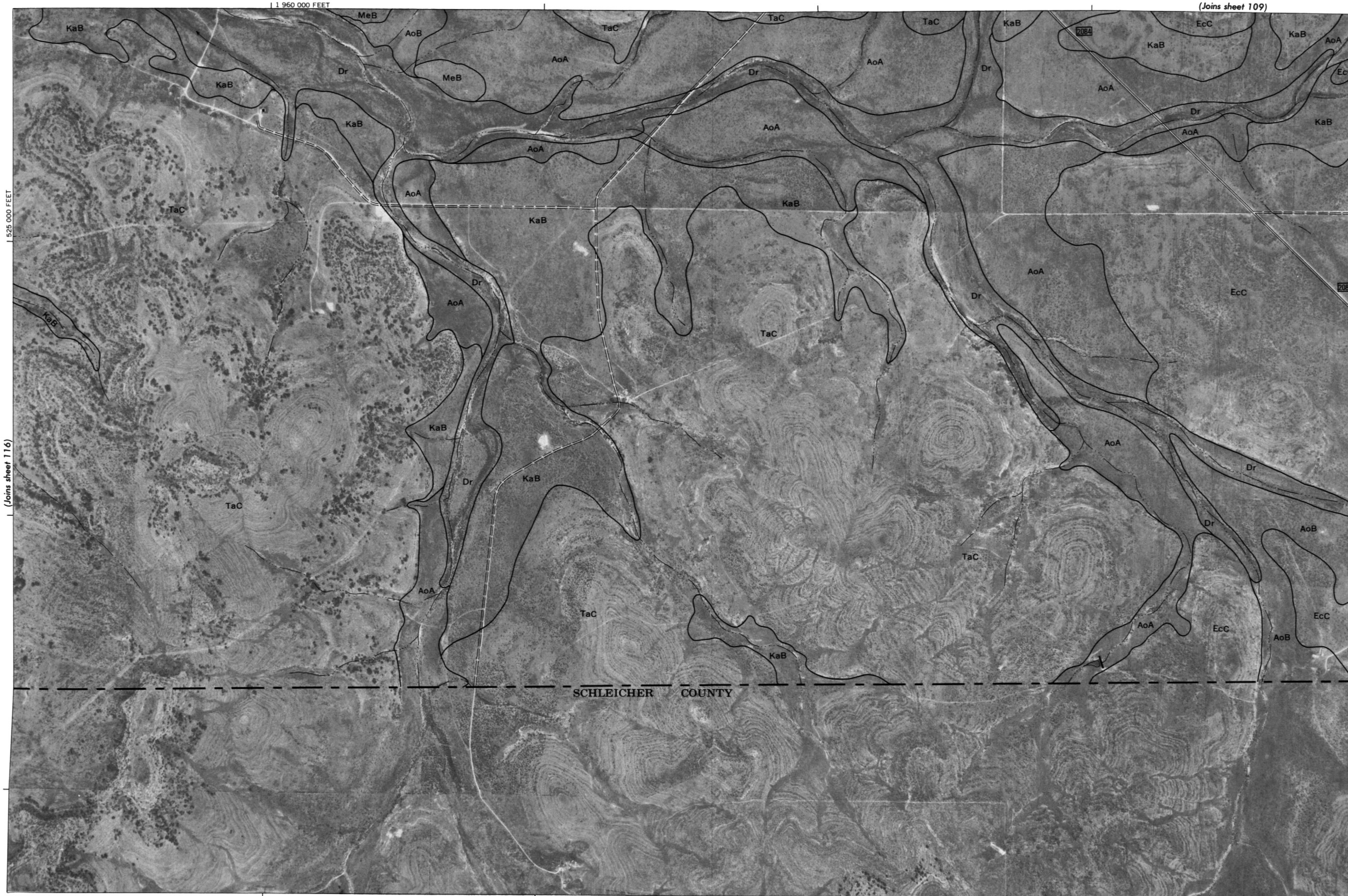
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 116

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 117

117



N

1 Mile

5000 Feet

0 0

1000

¼

2000

½

3000

¾

4000

1

5000

Scale 1:20000

This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 118

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

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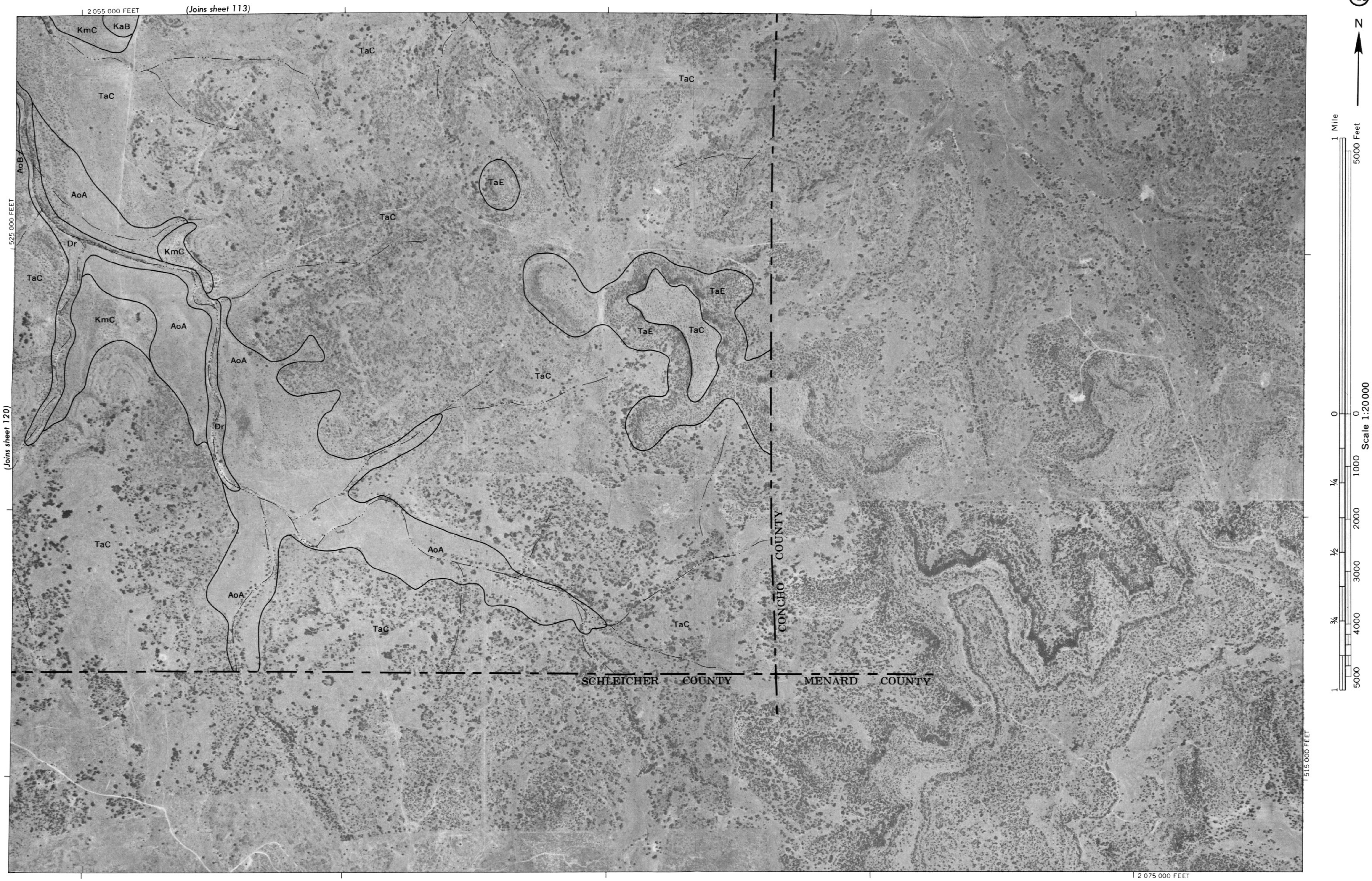
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 120

Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.
This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

TOM GREEN COUNTY, TEXAS — SHEET NUMBER 121



This map is one of a set compiled in 1974 by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Texas coordinate system, central zone.